PB89-188759

Superfund Record of Decision (EPA Region 10): Martin Marietta Site The Dalles, Oregon, (First Remedial Action), September 1988

(U.S.) Environmental Protection Agency, Washington, DC

29 Sep 88

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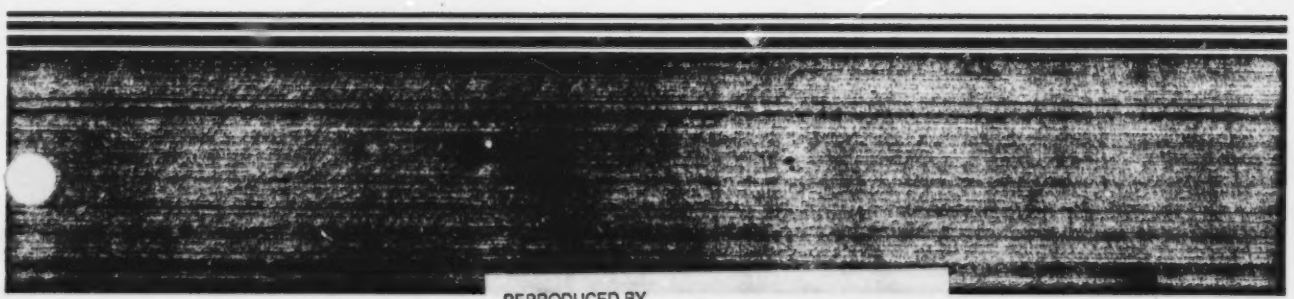
Superfund Record of Decision:

Martin Marietta, OR



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15. Supplementary Notes

16. Abstract (Limit: 200 words)

The 350-acre Martin Marietta Reduction Facility (MMRF) site is located in The Dalles, Wasco County, Oregon. The site lies within an 800-acre area used primarily for heavy industry and manufacturing; land not used for industrial processes is leased for agricultural purposes. Less than 20 homes and businesses are located in the area of the site. Ground water is an important source of water supply in The Dalles area for domestic, industrial and agricultural uses and flows in an easterly direction, toward the Columbia River. From 1958 to 1970, Harvey Aluminum, Inc. operated a processing facility designed to produce about 90,000 tons of aluminum a year. Martin Marietta Corporation (MMC) acquired the facility in 1970 and continued aluminum processing operations until 1984, when the plant was shut down. In 1986, MMC leased the plant and adjacent portions of the property to Northwest Aluminum Company, which resumed aluminum operations in 1987. The MMRF site consists of 28 areas of significant contamination resulting from treatment, storage, and disposal practices at the site. A 15-acre landfill located near the aluminum reduction building contains approximately 200,000 yd^3 of waste and plant construction debris. Leachate emanating from the landfill operations prior to the installation of a leachate collection system has resulted in the contamination of the area aquifer. Significant waste types in the landfill include
(See Attached Sheet)

17. Document Analysis a. Descriptors

Record of Decision
Martin Marietta, OR
First Remedial Action - Final
Contaminated Media: debris, gw, soil
Key Contaminants: metals (arsenic), inorganics (asbestos), organics (PAH), VOCs (TCE)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

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EPA/ROD/R10-88/017
Martin Marietta, OR
First Remedial Action - Final

16. ABSTRACT (continued)

asbestos, metallic wastes, and 5,000 tons of spent cathode waste materials containing cyanide, PAHs, and arsenic. In addition to the landfill, approximately 64,670 yd^3 of cathode waste material was deposited in areas referred to as the unloading area and the cathode waste management areas. And scrubber sludge ponds, consisting of 4 surface impoundments, two of which are covered with soil and vegetation, cover 14.8 acres and contain contaminated sludge and subsoil. The primary contaminants of concern affecting the soil, ground water, and debris are VOCs including TCE, organics including PAHs, inorganics including asbestos and cyanide, and metals including arsenic.

The selected remedial action for this site includes: excavation of the cathode waste material and placement into the existing landfill, and covering the landfill with a RCRA cap; placement of a soil cover over scrubber sludge ponds 2 and 3; plugging and abandonment of nearby production wells and connecting ground water users to the City of Dalles water supply system; collection and onsite treatment of leachate generated from the landfill, the perched water east of River Road and the cathode waste management areas, and the ground water in the unloading area using an aqueous treatment system with onsite discharge to a recycling pond; ground water monitoring; establishment of a contingency plan to perform additional recovery of ground water in the event further contamination is detected; and implementation of institutional controls. The estimated present worth cost for this remedial action is $6,707,400 with annual O&M of $144,000 for years 1-5 and $55,600 for years 6-30.

5

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Martin Marietta
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RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION
REMEDIAL ACTION
MARTIN MARIETTA SITE
THE DALLES, OREGON

RECORD OF DECISION

REMEDIAL ALTERNATIVE SELECTION

Site

Martin Marietta site - The Dalles, Oregon.

Purpose

This decision document presents the selected remedial action for the site, developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and consistent with (where not precluded by SARA) the National Contingency Plan (NCP, 40 CFR Part 300). The State of Oregon Department of Environmental Quality concurs with the selected remedy.

Basis for Decision

The decision is based upon the Administrative Record for the site. This record includes, but is not limited to, the following documents:

- Final Remedial Investigation Report for the Martin Marietta site, The Dalles, Oregon (March, 1988)
- Final Feasibility Study Report for the Martin Marietta Site, (June 1988)
- Decision Summary of Remedial Alternative Selection (attached)
- Responsiveness Summary (attached as Appendix B)
- A complete list of documents contained in the Administrative Record is included as Appendix C

Description

This remedial action is designed to:

- Consolidate the residual cathode waste material and underlying fill material from the Former Cathode Waste Management Areas into the existing Landfill;
- Consolidate the cathode waste material from the Unloading Area into the existing Landfill;
- Cap the existing Landfill in place with a multi-media cap meeting RCRA performance standards;
- Place a soil cover over Scrubber Sludge Ponds 2 and 3;
- Plug and abandon nearby production wells and connect users to the City of The Dalles water supply system;
- Collect and treat leachate generated from the Landfill and perched water east of River Road and from the Former Cathode Waste Management Areas;
- Recover contaminated groundwater from the Unloading Area;
- Implement groundwater quality monitoring and a contingency plan to perform additional recovery of groundwater in the event that further contamination is detected.

Institutional controls such as deed restrictions or fencing will be implemented during and after remediation. The purpose of these controls will be to assure that the remedial action will protect public health and the environment during its execution, and to ensure a similar level of protection after the remedial actions have been implemented.

Declaration

Consistent with CERCLA, as amended by SARA, and the NCP, EPA determines that the selected remedy as described above is protective of human health and the environment, attains Federal and State requirements which are applicable or relevant and appropriate, and is cost-effective. EPA Determines that this remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. The statutory preference for treatment is not satisfied because treatment was not found to be practicable. Treatment of contaminated soils at the site was not found to be practicable given the nature of the risks involved and the protectiveness of the selected remedy. Treatment of contaminated groundwater is included in the selected remedy.

9-29-96

Date

Regional Administrator
Environmental Protection Agency
EPA - Region 10

DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION
FINAL REMEDIAL ACTION
MARTIN MARIETTA SITE
THE DALLES, OREGON

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I. SITE DESCRIPTION AND BACKGROUND

The Martin Marietta Reduction Facility (MMRF) site is located in The Dalles, Wasco County, Oregon, west of the Columbia River and east of the Union Pacific Railroad line. The site occupies approximately 350 acres within an 800-acre area zoned for heavy industry and manufacturing. The area of the site used for industrial purposes encompasses approximately 110 acres in sections 21,28,33 and parts of sections 20 and 29 in T.2N, R.13E., Willamette Meridian. The MMRF is bounded near the Mountain Fir wood hauling and chip mill on the north, Webber Street to the south, the Columbia River on the east, and the Union Pacific Railroad line and West Second Street to the west.

The MMRF is an aluminum processing facility designed to produce approximately 90,000 tons per year of aluminum from alumina. Operations were begun at the site by Harvey Aluminum, Inc., in 1958. That company became a wholly owned subsidiary of Martin Marietta Corporation (MMC) in 1970. The MMRF continued operations until 1984, when the plant was shut down and MMC acquired legal title to the property. In 1986, MMC leased the plant and portions of property adjacent to the plant to Northwest Aluminum Company, which resumed primary aluminum operations in 1987.

During facility operation, waste constituents derived from alumina reduction were stored, treated, and disposed of at the MMRF. During past plant operations, waste constituents, principally fluoride, sodium, sulfates, cyanide, and polynuclear aromatic hydrocarbons (PAHs), were released to the environment.

Site Features

The MMRF is located within the semi-arid region of eastern Oregon where the climate is characterized by warm, dry summers and cold, relatively wet winters. At The Dalles, the mean annual temperature is about 54°F. July is generally the warmest month with a mean maximum temperature of 86°F. The mean minimum temperature is 34°F in January.

The area receives from 10 to 15 inches of precipitation annually with a mean annual precipitation at The Dalles of 13.7 inches. Average annual evaporation from shallow lakes in the area is approximately 40 inches. Records from The Dalles indicate a cumulative moisture deficit of about 15 inches per year; that is, evaporation exceeds precipitation.

Wind velocity measured at an on-site meteorological station during the months of June and July 1987 showed maximum wind speeds of up to 60 miles per hour (mph); gusts of up to 30 mph were common. The highest wind speeds are associated with northwest winds. Typical wind speeds range from 5 to 20 mph and the predominant wind direction is from the northwest.

Land-surface elevations at the MMRF range from about 100 ft msl at the Columbia River to more than 155 ft msl at the Landfill. The topography of the site has changed over time due to filling of low areas; in general, the site is level with the exception of distinct man-made and natural features. These features include: man-made ponds, the landfill, drainage ditches, stream channels, and road beds. These site features are shown in Figure 1.

The topography at the MMRF largely controls the direction of surface-water flow, except where man-made structures have been built to alter flow patterns. In general, surface-water runoff from active portions of the site is routed to the recycle pond. Surface-water flows are shown in Figure 2.

Runoff from the landfill area is currently intercepted by the leachate collection system and the landfill ditch and then routed to the recycle pond via the discharge channel. Prior to the construction of this interception network, landfill runoff followed three primary drainage pathways, all of which discharged to the alluvial aquifer. Those flows are now collected in the leachate collection system.

Surface ponds at the MMRF include the four scrubber sludge ponds, recycle pond, duck pond, and lined pond. The recycle pond serves as a collection point for runoff from the landfill, the former cathode waste management area, and areas to the immediate south and west of the plant, and it discharges to the Columbia River in accordance with a National Pollutant Discharge Elimination System (NPDES) permit. The recycle and lined ponds are currently in use. The scrubber sludge ponds are no longer in use but intersect the water table and are saturated in proportion to the relative groundwater elevation.

Surface-water runoff from the southwest part of the site flows to the south and east through a natural drainage channel prior to discharging to the Columbia River. Surface-water drainage from the non-active part of the MMRF (northwest of the landfill) discharges directly to Chenoweth Creek.

Lithology/Geology. The surface soils at The Dalles are poorly developed and in most places are non-existent. During construction and operation of the MMRF, a large part of the native soils at the site were covered with fill material.

Underlying the soils/fill at the site is rock of the Columbia River Basalt Group (CRBG). The rock strata at the site are generally flat lying except in the north where the Chenoweth Fault transects the site. The CRBG is overlain by Pleistocene Age alluvial deposits in the northern parts of the site.

Existing and Future Land and Groundwater Use. The MMRF, as noted previously, is located within 800 acres zoned for heavy industry and manufacturing. Northwest Aluminum is currently the largest industry in this zoning area, employing 250 to 300 persons.

A small trucking facility, plant recreation area, and a rodeo grounds are located near the southern boundary of the industrial area. The northern part of the area contains the Mountain Fir facility and two small areas zoned as community facilities. Located within these community facilities are the Wasco County Animal Shelter, Rockline (which consists primarily of a machine shop employing about four people), and an electric power substation. A gravel pit owned by Munson Paving is also located in the northern part of this zoning area.

Currently, there is little development along the Columbia River waterfront in the vicinity of the MMRF, although there are plans to use a tract between the site and the river for industrial development. The area has been leveled, graded, and landscaped. A small barge company is located on the waterfront approximately 0.5 mile southeast of the MMRF.

The remainder of the zoning area is lightly vegetated or wooded; MMRF land that is not used for industrial processes is leased for agricultural uses such as cattle grazing. Cattle grazing takes place primarily in the vegetated areas northeast of the facility and in the area near the rodeo grounds.

Interstate 84 separates the light and heavy industrial manufacturing area from residential areas. Directly west of the interstate and approximately one-third of a mile from the MMRF site are several areas zoned for residential development. General commercial sites, such as a drive-in theater, are located in and around these residential areas, approximately two-thirds of a mile west of the MMRF. Additional residential areas zoned for single-family, multi-family, and mobile home dwellings are located southwest of the site.

A gravel pit is operated within the quaternary gravels of the alluvial aquifer northeast of the MMRF. This operation is relatively small, and probably could not be expanded significantly owing to the limited extent of the alluvium.

Nearby Residences. A strip of land zoned for light industrial and manufacturing development is located between the railroad tracks and Interstate 84 directly west of the MMRF main building. In addition to several small businesses, this area currently includes a few residential homes. These homes were in place prior to zoning, and upon new ownership or destruction of the homes, the area will be used strictly for light industrial and manufacturing development. Based on recent aerial photographs, less than 20 homes and businesses are in the area west of the site.

Natural Resources. Groundwater is an important source of water supply in The Dalles area for domestic, industrial, and agricultural uses. The primary aquifer in the area is the Dalles Groundwater Resevoir (DGWR); the alluvial aquifer located in the Chenoweth Creek area is used by the Animal Shelter.

The Columbia River and its tributaries represent the major surface-water resources in the area, with an impoundment on Mill Creek used as the principal source of water supply for the City of The Dalles. The Columbia River and its tributaries provide habitat for important commercial and sport fisheries, with salmon, trout, steel head, walleye, and bass being among the many game fish common to the river. Many of the tributaries serve as hatcheries for the salmonoids.

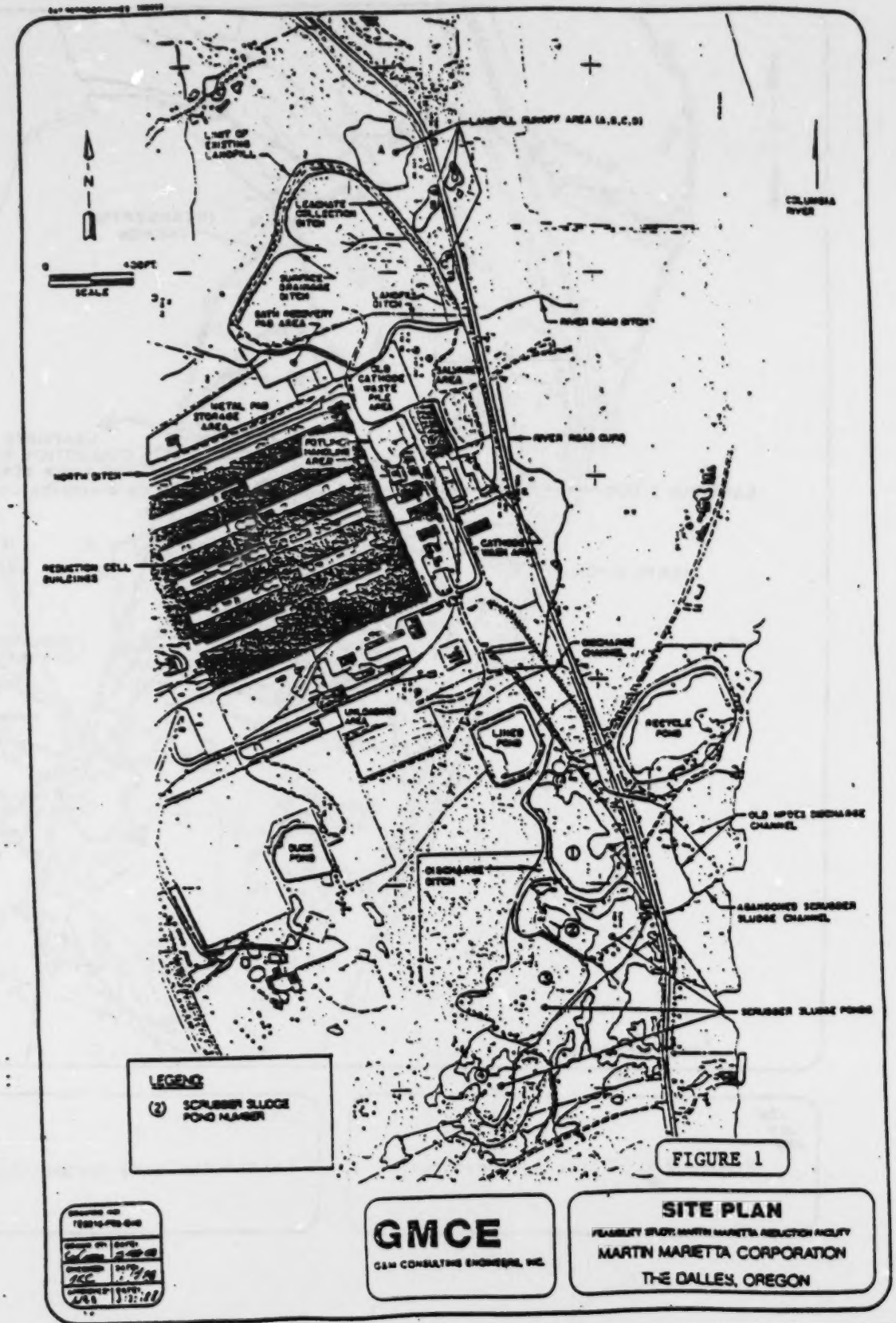

FIGURE 1

GMCE
G&M CONSULTING ENGINEERS, INC.

SITE PLAN
FEASIBILITY STUDY: MARTIN MARIETTA REDUCTION FACILITY
MARTIN MARIETTA CORPORATION
THE DALLES, OREGON

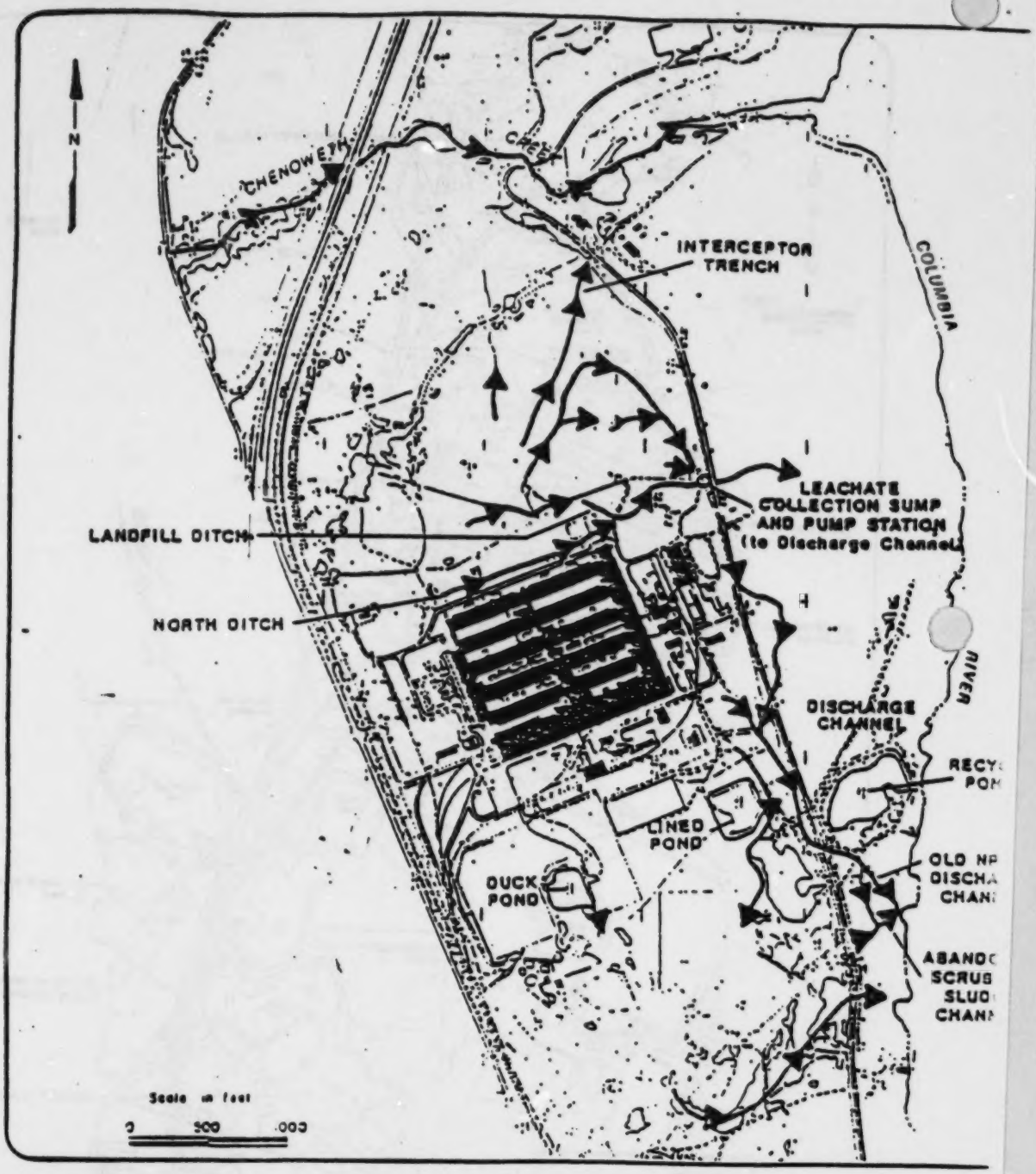

Figure 2 Site Drainage Features.

CLIENT NAME:

Martin Marietta Corporation

II. ENFORCEMENT SUMMARY

In the spring of 1983, the presence of cyanide compounds were detected in the groundwater and the EPA ranked the facility for inclusion on the NPL. The site was proposed for the NPL in October 1984. In 1987 the site was formally placed on the NPL.

MMC has been identified as a Potentially Responsible Party for the site. MMC entered into a Consent Order with EPA in September 1985 that directed MMC to perform an RI/FS for specific areas at the site that might have been impacted during plant operations. The Final FS report was submitted in July, 1988. MMC is in compliance with the terms of the order.

Special Notice has not been issued in this case to date.

III. COMMUNITY RELATIONS

Community concern about the Martin Marietta site has never appeared to be widespread, although several issues and questions were raised. These three issues were raised by several community members:

* the concern over cyanide contamination;

* the importance of the aluminum reduction facility to the local economy; and

* concerns about various airborne emissions from the smelter.

The remedial investigation addressed the concerns about cyanide, concluding that there is no significant cyanide contamination in groundwater beneath the site. The reduction facility was leased and reopened by NW Aluminum, which has improved their practices for handling the wastes which earlier caused the contamination now beneath the site. Finally, as a result of a lawsuit, Martin Marietta installed new flouride emission control equipment.

Judging from the fact that EPA received no written comments on the Feasibility Study despite 2 public meetings, 2 fact sheets, and several public notices about the Feasibility Study and comment period, EPA concludes that the community's concerns have been addressed and that they are relying on EPA and DEQ to select an appropriate remedy. The selected remedy takes into account the concerns mentioned above.

IV. NATURE AND EXTENT OF PROBLEM

Site Characterization

The site consists of a number of areas of contamination that have resulted from past practices at the site. These areas are shown on Figure 1 and include:

Landfill

Landfill Runoff Areas
- Area A
- Area B
- Area C
- Area D

Former Cathode Waste management Areas
- Metal Pad Storage Area
- Bath Recovery Pad Area
- Old Cathode Waste Pile Area
- Salvage Area
- Potliner Handling Area
- Cathode Wash Area

Duck Pond

Lined Pond

Recycle Pond

Scrubber Sludge Ponds
- SSP1
- SSP2
- SSP3
- SSP4

Drainage Ditches
- Surface Drainage Ditch
- Leachate Collection Ditch
- Landfill Ditch
- North Ditch
- River Road Ditch
- River Road Curb
- Discharge Channel
- Drainage Ditch
- Old NPDES Discharge Channel
- Abandoned Scrubber Sludge Channel

More detailed descriptions of those areas where significant contamination was detected are included in the next section entitled "Waste Characterization of Areas Investigated".

Table 1 shows a chronology of significant events at this site that have contributed the present state of these areas. The chronology shows that many of the past practices, particularly those involving disposal of cyanide containing waste, have been corrected prior the initiation of the RI/FS. In this respect the selected remedy is considered as a supplement to corrective actions that have already been performed.

Table 1 Chronological History of MMRF Operations

Dates	Event
1957 through 1960	Plant construction debris placed in the Landfill.
1958	Process operations initiated by Harvey Aluminum, Inc. Plant air emissions collected in a wet primary fluoride scrubber system (known as the "Old Tower" system) and discharged to Scrubber Sludge Ponds 2 and 3.
1960	Old Cathode Waste Pile started at northeast corner of the plant. Old Cathode Wash Area constructed east of plant and next to River Road.
1961-1971	Bricks separated from cathodes taken out of service placed in the Landfill. Other cathode waste shipped off-site for processing.
1970	Secondary wet fluoride scrubber system added to primary air pollution control system.
1974-1984	Waste from the Casthouse, Paste Plant, and plant operations deposited in the Landfill.
1980	Lined pond constructed to reduce volume placed in the Scrubber Sludge Ponds.
1981	Use of Scrubber Sludge Ponds 1 and 4 discontinued; ponds capped.
1983	State of Oregon Department of Environmental Quality lists potliner waste as hazardous. Permitted waste pad built to store waste potliner; potliner waste previously stored at the Old Cathode Waste Pile relocated to the permitted storage area.
1984	Martin Marietta Corporation acquires legal title to property from Martin Marietta Aluminum, Inc. Martin Marietta Corporation constructs leachate collection system for the Landfill and new Cathode Waste Pad. Remaining Old Cathode Waste Pile waste and six inches of soil relocated to the new Cathode Waste Pad.

Waste Characterization of Areas Investigated

Landfill

Shown in Figure 1, the landfill occupies approximately 15 acres just north of the alumina reduction building. Former drainage pathways from the landfill area correspond to the landfill runoff areas.

Wastes at the landfill were placed randomly on the ground surface and piled to the current configuration; total waste volume is estimated to be about 200,000 cubic yards. Wastes present in the landfill as a result of the reduction process and construction operations consist of: construction debris (primarily basalt fragments); "target wastes" such as spent cathode waste materials, refractory bricks, off-specification carbon block, pitch, coke and cryolite; and metallic wastes such as buss bars and collector studs, and pallets, cans, rags, and empty drums. Prior to the regulation of asbestos disposal and handling practices, asbestos and materials containing asbestos were disposed of in a random fashion within the landfill. Since regulation of these materials, MMRF disposed of asbestos in discrete areas of the landfill.

The following volumes have been estimated for the waste types in the landfill:

• Basalt Fragments	100,000 yds.
• Asbestos	300 yds.
• Metallic Wastes	500 yds.
• Target Wastes	99,200 yds.

Of the target wastes, it is estimated that 5,000 tons of spent cathode waste materials are present in the landfill; these wastes contain high levels of carbon, sulfate, sodium, and fluoride in addition to minor amounts of cyanide. Cryolite, which is composed of fluoride, sodium, and aluminum, is also present in the landfill. Pitch and coke associated with the continuous anode in the reduction process are present in the landfill and contain elevated levels of PAHs and low levels of arsenic.

To confirm the composition of the landfill, five test pits were excavated. The materials observed ranged from fine dust to very large basalt boulders. Samples from the five test pits indicate the presence of the following contaminants:

• EP Toxicity - Barium	0.234 mg/L (one sample)
• Total cyanide	0.32 - 70 mg/kg
• Free cyanide	0.27 - 54 mg/kg
• Sodium	3,400 - 82,200 mg/kg
• Fluoride	204 - 2,880 mg/kg
• PAHs	276 - 2,406 mg/kg

Former Cathode Waste Management Areas

Past cathode waste management activities were concentrated near the northeast corner of the plant building. These areas include the metal pad storage area, the bath recovery area, the salvage area, the cathode wash area, the potliner handling area and the old cathode waste pile. In addition to the perched water identified in this area, the potliner handling area was identified as the main area of concern in terms of direct human exposure to soils, and is described in more detail below. In addition, these areas were identified as potential sources of fluoride contamination to groundwater.

Potliner Handling Area. The potliner handling area (PHA) occupies approximately 0.9 acre, just east of the reduction building (See Figure 1). The PHA was used during the period when waste cathode was crushed and loaded onto railroad cars for off-site recycling. As a result of the crushing process, cathodic dust, pitch, and coke residuals have accumulated. Sampling of the PHA indicated the presence of the following contaminants:

• Cyanide	
- Total	14 mg/kg
- Free	4 mg/kg
• Fluoride	673 mg/kg
• Sodium	29,600 mg/kg
• PAHs	9,041 mg/kg

Scrubber Sludge Ponds

The scrubber sludge ponds (SSPs) consist of four surface impoundments (numbered 1 through 4) located south of the reduction buildings and west of River Road. The large surface area and retention capacity of the SSPs allowed for particulate settlement of slurry waters from the air pollution control system prior to discharge of accumulated water to the Columbia River.

Collectively, the lateral extent of the SSPs is approximately 14.8 acres. SSP1 and SSP4 have soil covers and established vegetation which currently precludes direct contact with the wastes. SSP2 and SSP3 are not covered. The material present in the SSPs can be divided into three categories: (1) soil cover, (2) sludges, and (3) contaminated subsoils. The volumes for each SSP by category are presented below:

Pond	Cover	Sludge	Subsoil	Subtotal
SSP1	7,970	63,730	-	71,700
SSP2		6,820	2,760	9,580
SSP3		43,600	14,500	58,100
SSP4	4,640	17,660	6,200	28,500
			TOTAL	167,880

In addition, prevalent winds have scattered approximately 538 cubic yards of sludge south of SSP2 and SSP3.

Samples from the scrubber sludge ponds indicate the presence of the following contaminants:

• Cyanide - Free	Below detection limit(BDL)
• Fluoride	204 - 613 mg/kg
• Arsenic	BDL - 77 mg/kg
• Sodium	6,250 - 45,000 mg/kg
• VOCs	BDL
• PAHs	1,940 - 8,570 mg/kg

Surface Drainage Ditches

Leachate generated by the landfill is contained by a leachate collection system that consists of the following ditches (Shown in Figure 2):

- Surface Drainage Ditch;
- Leachate Collection Ditch; and
- Landfill Ditch.

The generation of leachate is seasonally dependent and its presence is directly related to precipitation or snow melt. Available records of leachate collected and pumped range from 0 to 50,000 gallons per day (gpd) with peak flows occurring generally in the early spring. Concentrations of contaminants in the landfill leachate also vary with season and are higher when leachate is being developed.

The following compounds were identified in the leachate collection ditch identified the presence of the following constituents:

• Volatile Organic Compounds	
• Trichloroethylene	8 mg/L (one sample)
• Cyanide	
- Total	0.11 - 29 mg/L
- Free	0.01 - 4.7 mg/L
• Fluoride	1,490 - 2,440 mg/L
• Sodium	4,270 - 5,900 mg/L
• Sulfate	840 - 2,660 mg/L

Analyses of leachate samples from the landfill ditch identified the presence of the following constituents:

• PAHs (including Bis[2-ethyl-hexyl]Phthalate)	0.01 - 206 ug/L
• Cyanide	
- Total	373 - 1,280 mg/L
- Free	34.2 - 77.2 mg/L
• Fluoride	5,400 - 8,000 mg/L
• Sodium	36,600 - 99,800 mg/L
• Sulfate	10,500 - 49,300 mg/L
• Chloride	1,210 - 3,430 mg/L

Sediments from the surface drainage ditch showed the following contaminants:

• Cyanide	
- Free	< 0.62 - 3.6 mg/kg
• Fluoride	189 - 519 mg/kg
• Sodium	2,720 - 5,600 mg/kg

Groundwater Characterization

General Hydrogeology

The groundwater flow system at the MMRF includes a water-table aquifer (S aquifer) overlying a series of confined aquifers (A and B aquifers and DGWR). Figure 3, a site specific stratigraphic column, shows the vertical relationship between the principle aquifers at the site. Zones of perched water near the surface of the old cathode waste pile and an alluvial aquifer are also present locally.

Distribution of Main Aquifers. The unconfined S aquifer is present within the relatively low permeability areas of the basalt south of the landfill, though a small area of S-Aquifer was also defined northeast of the landfill. The S aquifer generally thins out toward the western portion of the facility. The first confined aquifer (A aquifer) is within the upper pillow lava horizon of the subaqueous portion of the Rosalia flow. The A aquifer ranges from 100 to 150 ft below the surface and is 5 to 45 feet in thickness. The B aquifer is below the A aquifer and is locally separated from it by a low permeability basalt (lava lobe). The lava lobe is apparently absent north of the site due to non-deposition. The B aquifer ranges from 150 to 200 ft below the surface and is 30 to 50 ft in thickness. In areas where the lava lobe is absent, the A and B aquifers combine to form a single hydrogeologic unit. A thick, low permeability siltstone and sandstone unit forms the confining unit between the B aquifer and the underlying DGWR. The top of the DGWR occurs at depths greater than 220 feet below the surface.

Localized Groundwater. An alluvial aquifer, approximately 400 ft wide and at least 60 ft deep, is present in the area north of the plant. The geometry of the alluvial aquifer is apparently controlled by the location of the trace of the Chenoweth Fault. Flow in the alluvial aquifer is expected to be east, toward the Columbia River.

Perched water has been identified at the old cathode waste pile, salvage area, and potliner handling areas within the permeable fill material that exists above competent basalt. The saturated thickness of the perched zone varies, ranging from 0 to 3 ft during the RI. One source of the perched water is precipitation; other potential sources include infiltration from the landfill ditch and north ditch, and leaks in below-grade water distribution lines.

Groundwater Flow. Groundwater flow in the S aquifer is generally to the east and northeast; discharge from the S aquifer is believed to be into the alluvial aquifer where it intersects the S-aquifer at the northern portion of the facility, and to the Columbia River. Groundwater flow in the A aquifer is predominantly east to west. The A aquifer may be recharged by the alluvial aquifer, the Columbia River, and the S aquifer; discharge appears to be to the B aquifer and regional water-supply wells. Groundwater flow in the B aquifer is generally to the west and south; hydraulic gradients vary, however, depending on the hydrologic and pumping conditions.

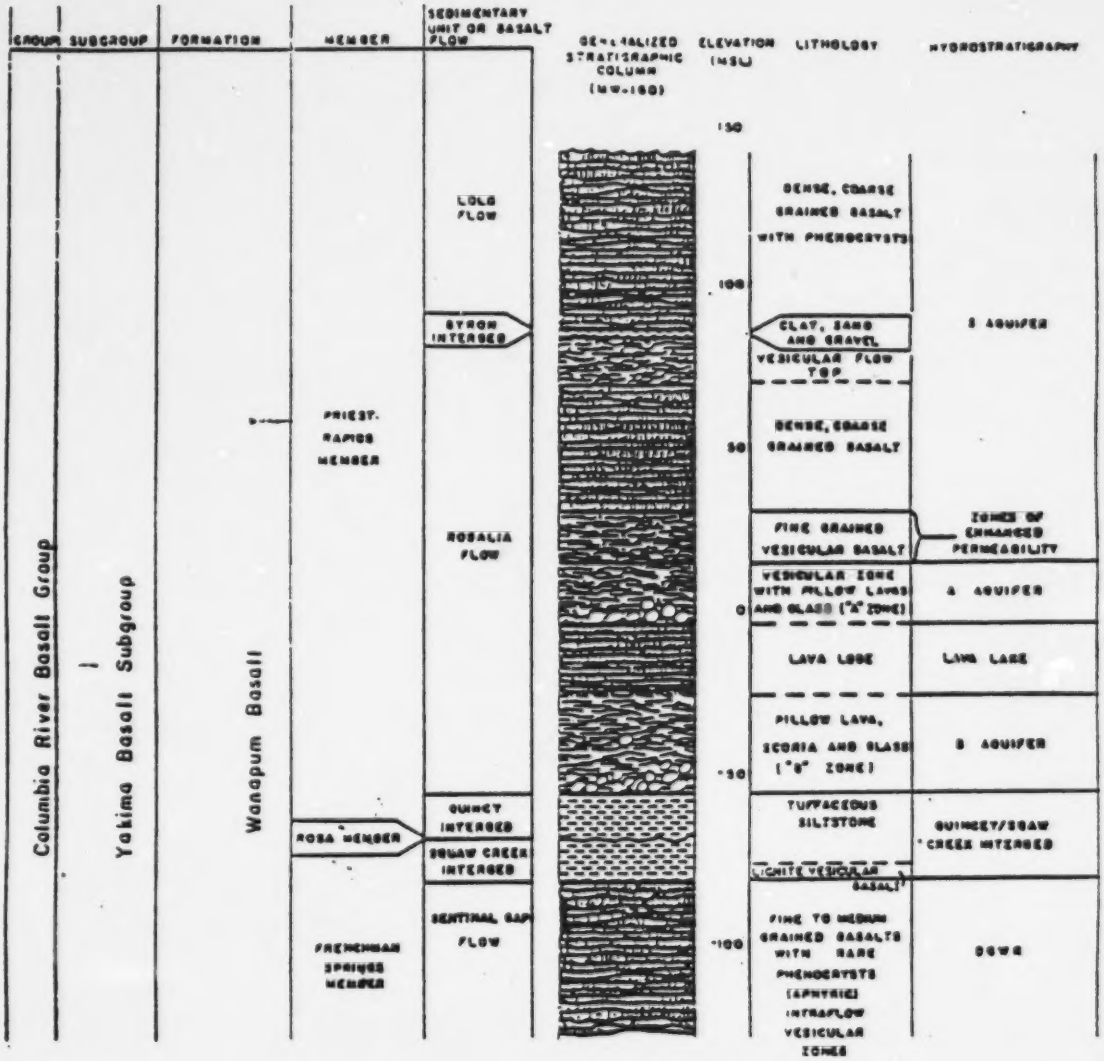

Figure 3 Site-Specific Stratigraphic Column.

CLIENT NAME:

Martin Marietta Corporation

Chemical Characterization of Groundwater

The constituents of concern identified in the groundwater system include total and free cyanide, fluoride, sodium, and sulfate. The highest constituent concentrations are present in the perched water with progressively lower concentrations identified within the S, A, and B aquifers. Concentrations of constituents in wells tapping the DGWR are well below health based standards. Table 2 lists potential ARARs and other health based standards for groundwater to be considered in selecting a remedy.

Localized Groundwater. Perched water samples from the old cathode waste pile show elevated concentrations of free cyanide (3.01 mg/L), fluoride (3,000 mg/L), and sodium (10,500 mg/L). No free cyanide or fluoride was detected in samples from the well in the alluvial aquifer at the Animal Shelter. Other wells in the alluvial aquifer were above detection limits but below health based standards.

S Aquifer. Elevated constituent concentrations were identified in the S aquifer at several locations:

(1) Near the landfill and former cathode waste management area. Fluoride concentrations range from <1.0 mg/L to 4.7 mg/L. Free cyanide ranged from <0.09 to 0.136 mg/L, and sodium ranged from 57.2 to 82.2 mg/L.

(2) Scrubber sludge ponds. This area contains fluoride (4.8 to 7.1 mg/L), sodium (246 to 658 mg/L), and sulfate (117 to 3,020 mg/L). Free cyanide is below detection limits.

(3) The new cathode waste area near the alumina unloading building. Free cyanide was found at a concentration of 0.215 mg/L in well MW-5S. Sulfate is found at concentrations of up to 1,270 mg/L. Groundwater samples show detectable fluoride as high as 57 mg/l.

(4) Recycle pond. Samples from well MW-31 downgradient of the pond indicate fluoride concentrations of 5.5 mg/L, sodium concentrations of 90.5 mg/L, and sulfate concentrations of 871 mg/L.

Figure 4 shows fluoride concentrations in the S Aquifer.

A Aquifer. Groundwater quality impacts in the A aquifer are less widespread and at lower concentrations than those identified in the S aquifer. The highest concentrations in the A aquifer exist east of the landfill and the former cathode waste management area. The highest readings are reported for well MW-9A, but they are suspected to be an artifact of well construction. The monitoring and contingency plan described in the selected remedy will allow for a determination and appropriate action should these concentrations be found to be representative of groundwater conditions.

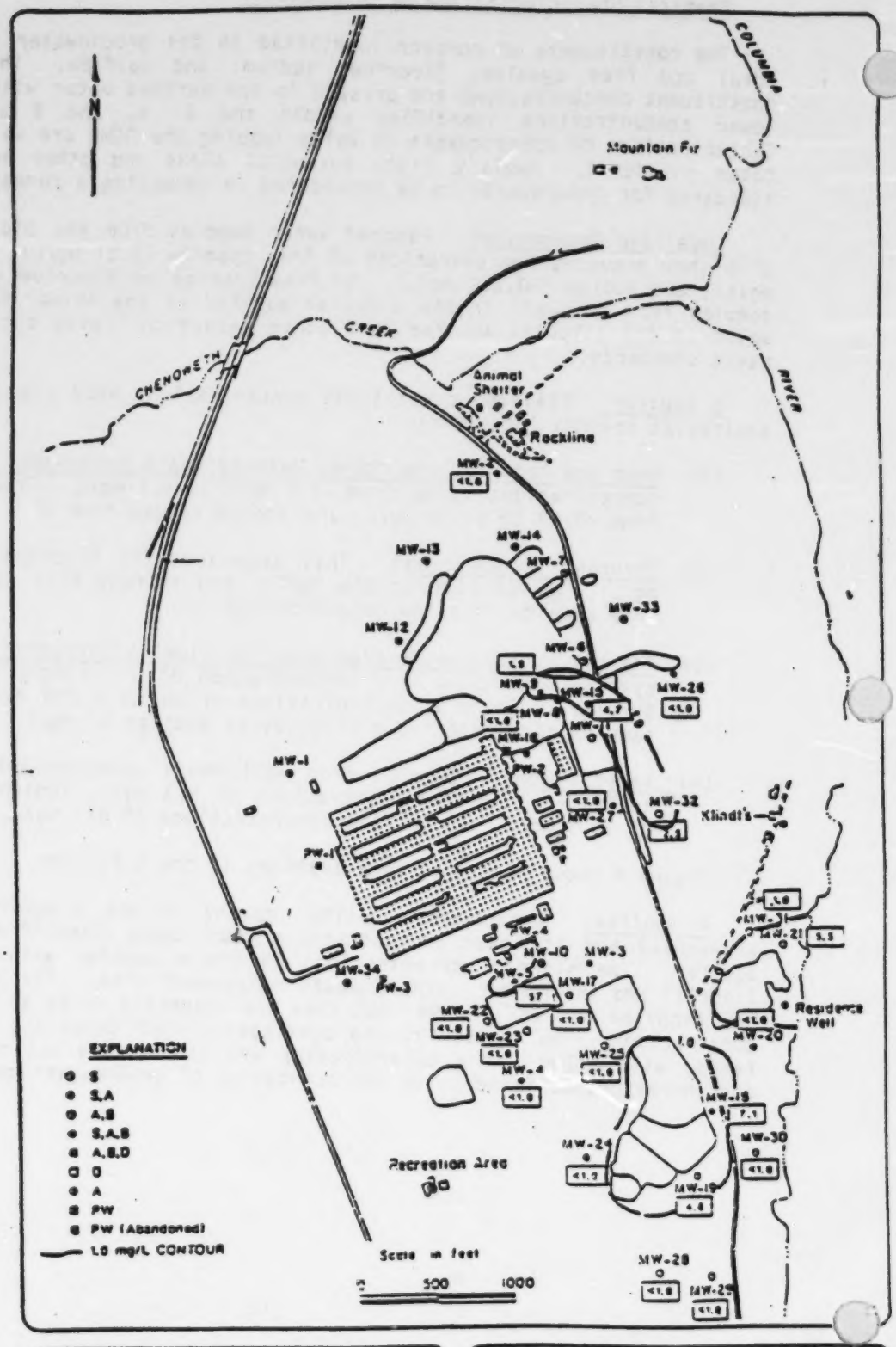

Figure 4 Fluoride Concentration, S Aquifer, August 1987.

CLIENT NAME:
Martin Marietta Corporation

TABLE 2

POTENTIAL ARARS AND OTHER GUIDANCE TO BE CONSIDERED

Chemical	Federal MCL (SMCL) [a]	Federal MCLG [b]	Oregon MCL [c]	Other
Bicarbonate	---	---	---	---
Calcium	---	---	---	---
Carbonate	---	---	---	---
Cyanide (free)	---	---	---	220 ug/L (child) [d] 770 ug/L (adult) [e]
Fluorides	4 mg/L (2 mg/L) [f]	---	1.4-2.4 mg/L [g]	---
Lead	50 ug/L	(20 ug/L)	---	---
Magnesium	---	---	---	---
Sodium	---	---	---	---
Sulfate	(250 mg/L)	---	250 mg/L	400 mg/L [h]
Zinc	(5 mg/L)	---	5 mg/L	---

[a] Maximum Contaminant Levels are enforceable drinking water standards from 40 CFR 141.11. These levels are based on health, technical feasibility, and cost benefit analysis. Secondary Maximum Contaminant Levels are shown in ( ) and are goals for drinking water quality based on aesthetic considerations such as taste, odor or straining ability, 40 CFR 143.3.

[b] Final and proposed MCLGs (maximum contaminant level goals) are developed as part of the process for developing final drinking water standards, (i.e., MCLs), under the Safe Water Drinking Act. MCLGs are entirely health-based and are always less than or equal to the proposed or final MCLs subsequently developed.

[c] Oregon Administration Rule 333-61

[d] Health advisory by USEPA Office of Drinking Water for longer-term exposure, March 1987; based on exposure to free cyanide.

[e] Health advisory by USEPA Office of Drinking Water for life time exposure for adults, March, 1987; based on exposure to free cyanide.

[f] National Primary and Secondary Drinking Water Regulations. Federal Register 51: 11396-11412, April 1986.

[g] Temperature dependent

[h] Level proposed by USEPA Office of Drinking Water 50 FR 46936, 13 Nov. 1985.

Contaminants are also present in the A aquifer near the scrubber sludge ponds. Sodium ranges from 44.7 to 84.8 mg/L, sulfate from 23 to 153 mg/L, and fluoride from <0.1 to 1.0 mg/L.

B Aquifer. In the B aquifer, elevated constituent concentrations are chiefly confined to a single location: the landfill and old cathode waste management area. The highest readings are reported for wells MW-9B and MW-8B, but they are suspected to be an artifact of well construction. The monitoring and contingency plan described in the selected remedy will allow for a determination and appropriate action should these concentrations be found to be representative of groundwater conditions. In other wells, levels of total cyanide range up to 1.0 mg/L. Free cyanide concentrations are 0.10 mg/L or less and fluoride concentrations are less than 1.4 mg/L.

Establishment of ACLs in the S Aquifer

An ACL is being proposed for those portions of the S Aquifer on the site where concentrations of fluoride and sulfate exceed Oregon MCL's, which are considered the more stringent standard at this site. Proposed ACL's are as follows:

Fluoride - 9.7 mg/l
Sulfate - 3,020 mg/l

Criteria for Establishment of an ACL. Section 121 (d)(2)(B)(ii) allows for the establishment of an ACL where:

- There are known projected points of entry of the groundwater into surface water,
- there will be no statistically significant increase of such constituents at the point of entry, and
- the selected remedy includes enforceable measures to preclude human exposure prior to discharge to the surface-water.

Projected Points of Entry. In general, the constituents of concern in groundwater at the site have been characterized as to their vertical and horizontal extent. The constituents of concern have primarily been identified in the uppermost aquifer at the site (S-aquifer) which is not currently used for water supply purposes in the area, is not really extensive, and is of low productivity and thus not likely to be utilized in the future for water supply purposes. Groundwater in the S-aquifer flows toward, and discharges to the Columbia River which borders the MMRF site. The Columbia River is extremely deep adjacent to the site, and there is essentially no potential for underflow from the S-aquifer.

The only surface-water potentially affected by groundwater which contains elevated levels of fluoride or sulfate is the Columbia River. The Columbia River currently receives discharges from the MMRF via a single discharge point regulated under a NPDES permit. The mass of fluoride currently discharged under the NPDES permit from the site is 123 pounds/day during the dry season and 246 pounds/day during the wet season.

Estimated Increase in Concentration at the Point of Entry. Fluoride and sulfate are both naturally occurring in the groundwater and surface-water environment. Background concentration of fluoride in the Columbia are reported to range from 0.24 mg/L to 0.7 mg/L. Background concentrations of sulfate in surface water are likely to range from 15.9 mg/L to 34 mg/L.

The hydraulic conductivity of the S-aquifer is approximately 2.1 ft/day; the hydraulic gradient in the S-aquifer is estimated to be 0.05 ft/ft. Assuming a cross sectional area of the S-aquifer which discharges into the Columbia River from the MMRF of approximately 6000 ft long (based on the length of the facility) by 50 ft deep (thickness of S-aquifer) gives and estimated contact area of 300,000 sq ft. This assumed contact area (300,000 square ft of the S-aquifer interfacing with the Columbia River) is significantly greater than the discharge area of the portion of the aquifer affected by site conditions. Groundwater discharge from the S-aquifer to the Columbia River is estimated to be 10 L/sec using this assumption.

The Columbia River in the area of the MMRF is very deep and flow is controlled by several dams in the area. The average flow in the Columbia River is approximately 192,820 cfs or 5,500,000 L/sec. The 7-day, 10-year low flow of the Columbia River in the area of the site is estimated to be 81,800 cfs.

Fluoride has been detected as high as 57 mg/L in groundwater at the MMRF; however, as part of the final remedy for the site, any groundwater with a concentration of greater than 9.7 mg/L will be remediated. Based upon a groundwater flux of 10 L/sec containing a worst case concentration of 9.7 mg/L of fluoride, the mass flux of fluoride to the Columbia River would be 97 mg/sec or 18.5 pounds per day. Under average flow conditions in the Columbia River, the average surface-water concentrations as a result of site groundwater discharge would be approximately 1.76 X 10-5 mg/L. A concentration increase of 1.6 x 10-4 mg/L is estimated assuming low flow conditions and a zone of mixing. For a maximum detected sulfate concentration of 3,020 mg/L in S-aquifer groundwater, the concentration in the Columbia River would be 5.5 X 10-3 mg/L under similar flow conditions.

These estimated concentrations of fluoride and sulfate as a result of groundwater discharges from the site are several orders of magnitude below acceptable concentrations, below detection limits and below background concentrations. Therefore, although a definable mass, the discharge of fluoride and sulfate to the Columbia River from on-site groundwater is statistically insignificant (not measurable).

Measures to Preclude Human Exposure. Institutional controls such as deed restrictions will be imple ented in the selected remedy to prevent the installation of wells on-site that draw water from the S-Aquifer.

Contaminant Transport

Air

In order to assess fugitive dust from the site, soil sieve analyses and fugitive particulate modeling was carried out. The results of this modeling indicated that the potential for significant risks from windblown dust were minimal.

Groundwater

Based on the hydrostratigraphy of the site, the principal route of concern for contaminant migration to Chenoweth irrigation wells involves horizontal migration from the landfill to the alluvial aquifer with subsequent downward migration to the B aquifer, and from there to the DGWR. A mathematical model was also developed to estimate the impacts on Chenoweth irrigation wells using this scenario. Using that model and including conservative assumptions, estimated concentrations of free cyanide at the wells were estimated as shown below. These can be compared to the health advisories shown in Table 2.

	CONSTITUENT CONCENTRATION (mg/l)		
	Initial	B-Aquifer	Production Well
Free CN	0.051	0.012	0.003

Risk Assessment

Exposure Evaluation

Chemicals of potential concern were evaluated in the risk assessment by first identifying the exposure pathways by which human and environmental populations could be exposed under either current land use or hypothetical future land use of the MMRF and surrounding areas. Many pathways involving human exposure to contaminated soils and dust were possible; therefore, for each category of exposure to soils (i.e., industrial or general population exposures, with and without soil disturbance at the site), the exposure scenario selected for evaluation was that which would result in the highest exposure, and therefore highest potential risk (worst case). This resulted in several exposure scenarios related to potential future uses of the site and surrounding areas, by both future industrial and residential populations, being evaluated. For each exposure scenario evaluated, an average case (populations exposed to average site chemical concentrations at average exposure frequencies, etc.) and a maximum exposure case (maximum reported concentration was used with upper-bound exposure scenarios) were evaluated.

Risk from these exposures were characterized in several ways. Because groundwater was the only exposure medium for which ARARs or health advisories were available for all chemicals of potential concern, risks associated with groundwater were assessed by comparing concentrations of chemicals in groundwater at points of potential exposure (both on and off site) to ARARs or health advisories, as has been previously discussed. Such comparison values were not available for all chemicals in other site exposure media (i.e., surface-water, and soil); exposure of humans to these contaminated media were evaluated by quantitative risk assessment in which potential intakes calculated for each potentially exposed population were combined with critical toxicity values.

Risks from Non-Carcinogenic Compounds. The non-carcinogenic chemicals of potential concern (e.g., fluoride and cyanide) are not expected to pose adverse health effects to humans under any of the soil-related exposure scenarios quantitatively evaluated; this conclusion is based on calculated hazard indices which were all several orders of magnitude less than 1 (the hazard index is defined as the sum of the ratios of the daily intakes of non-carcinogenic substances by potentially exposed individuals to their corresponding relevant reference dose or allowable intake).

Carcinogenic Compounds. Certain areas of the MMRF were identified in the risk assessment as being associated with potentially unacceptable carcinogenic risk to humans under the exposure scenarios assumed. These areas are listed below with details of the exposures, media, and chemicals which have been associated with this risk. The carcinogenic risks presented show a range that reflects both average exposure and high exposure values for differenct scenarios that were considered, including a residence scenario and a worker scenario.

Area	Estimated Carcinogenic Risk
Landfill and associated areas:	
direct contact with PAHs in landfill soils;	10^{-4} - 10^{-2}
direct contact with PAHs in surface drainage ditch sediments.	10^{-4} - 10^{-2}
Potliner Handling Area:	
direct contact with PAHs in soils.	10^{-4} - 10^{-1}
Discharge Channel:	
direct contact with PAHs in sediments.	10^{-4} - 10^{-2}
Scrubber Sludge Ponds:	
direct contact with PAHs in pond sediments;	10^{-4} - 10^{-2}

Ecological Effects

Pathways by which environmental receptors (flora and fauna) at and near the MMRF could potentially be exposed to site-derived chemical constituents were generally qualitatively evaluated due to the general paucity of data with which to evaluate such exposures. When sufficient data were available, estimates of risks to biota were made based on exposure and toxicity estimates. Estimated ecological impacts included:

* ingestion by wildlife of fluoride in leachate collection ditch water; and
* ingestion by wildlife of cyanide and fluoride in landfill ditch water;

Remediation Criteria

Based on the human health risks identified above and the potential for contaminant leaching to groundwater, remediation criteria for contaminated soils were established as follows:

Arsenic - 65 mg/kg
PAHs - 175 mg/kg
Fluoride - 2,200 mg/kg

V. ALTERNATIVES EVALUATION

Summary of Alternatives and Evaluation Criteria

This section summarizes the detailed evaluation of the final candidate remedial action alternatives. First, alternatives are subject to a screening for compliance with the protectiveness and ARAR criteria. An additional screening of cost effectiveness is then done to ensure the selected remedy is a cost effective one. Those that pass the screening are then evaluated against all nine criteria and an alternative is selected that best addresses the combination of criteria. This alternative is considered to represent treatment to the maximum extent practicable.

Alternatives were developed by first targeting areas for remediation based on identified public health and environmental concerns. These areas included:

* Landfill,
* Unloading Area,
* Former Cathode Waste Management Areas,
* Scrubber Sludge Ponds, and
* Groundwater

Table 3 shows the various remedial measures that were considered for each of these target areas. Table 4 shows how these measures were combined into the Final Candidate Alternatives.

The Final Candidate Alternatives, identified briefly, are:

Alternative 1 - No Action Alternative (presented to provide a baseline for evaluating the other alternatives).

Alternative 2 - Consolidation and Asphalt/Soil Capping of Target Areas; Limited Groundwater Treatment.

Alternative 3 - Consolidation and RCRA/Soil Capping of Target Areas; Limited Groundwater Treatment.

Alternative 4 - Consolidation and RCRA/Soil Capping of Target Areas; Hydraulic Barriers at Scrubber Sludge Ponds; Limited Groundwater Treatment.

Alternative 5 - Full Consolidation and RCRA Capping of Target Areas; Limited Groundwater Treatment.

Alternative 6 - Full Consolidation into RCRA Landfill; Limited Groundwater Treatment.

Alternative 7 - Full Consolidation and RCRA Capping of Target Areas; Complete Groundwater Treatment.

Alternative 8 - Full Consolidation into RCRA Landfill; Complete Groundwater Treatment.

Alternative 9 - Consolidation and RCRA/Soil Capping of Target Areas; Stabilization of Scrubber Sludge Ponds; Complete Groundwater Treatment.

Alternative 10 - Incineration with Complete Groundwater Treatment.

TARGET REMEDIATION AREA / REMEDIAL MEASURE	LANDFILL	UNLOADING AREA	FORMER CATHODE WASTE MANAGEMENT AREAS	SCRUBBER SLUDGE PONDS	GROUND WATER
CAPPING IN PLACE	●	●	●		
PARTIAL WASTE REMOVAL AND CAP IN PLACE			●		
CONSOLIDATION INTO EXISTING LANDFILL		●	●	●	
CONSOLIDATION INTO ON-SITE RCRA LANDFILL	●	●	●	●	
CONSTRUCT ON-SITE HEAP-LEACHING FACILITY	●	●	●		
IN-SITU HEAP-LEACHING	●				
INCINERATION	●	●	●		
STABILIZATION IN PLACE				●	
SOIL COVER				●	
SOIL COVER WITH SUBSURFACE BARRIER				●	
GROUND-WATER RECOVERY AND TREATMENT					●
P & A EXISTING WELLS AND PROVIDE CENTRAL WATER SUPPLY					●
RECASE EXISTING WELLS IN THE DGWR					●
CAPPING IN PLACE WITH A HYDRAULIC BARRIER				●	
LIMITED ACTION	●	●	●	●	●

TABLE 3

DRAWING NO: TE0018-P05-A74
DRAWN BY: SKF. DATE: 5/10/88
CHECKED: AZC DATE: 6-1-88
APPROVED: DATE: 6-1-88

GMCE
GAM CONSULTING ENGINEERS INC.

REMEDIAL MEASURES CONSIDERED FOR IMPLEMENTATION

FEASIBILITY STUDY: MARTIN MARIETTA REDUCTION FACI
MARTIN MARIETTA CORPORATION
THE DALLES, OREGON

TABLE 4

Summary of Assembled Remedial Alternatives and Component Remedial Measures
Feasibility Study: Myrtle Marlotte Reduction Facility
Myrtle Marlotte Corporation
Ipo Dalles, Oregon

Remedial Alternative Type	Remedial Alternative	Target Remediation Areas				
		Landfill	Unloading Area	Former Cathode Waste Management Areas	Scrubber Sludge Ponds	Ground Water
No Action Alternatives	Alternative 1	LF1: Limited Action	UA1: Limited Action	FCW1: Limited Action	SP1: Limited Action	GW1: Limited Action
Containment Alternatives	Alternative 2	LF2: Cap in Place (asphalt)	UA2: Consolidate into Existing Landfill	FCW2: Cap in Place (asphalt)	SP2: Soil Cover over SSP2 and SSP3	GW2: Ground-water Controls with Limited Treatment
	Alternative 3	LF2: Cap in Place (multi-media)	UA2: Consolidate into Existing Landfill	FCW4: Consolidate into Existing Landfill Landfill	SP2: Soil Cover over SSP2 and SSP3	GW2: Ground-water Controls with Limited Treatment
	Alternative 4	LF2: Cap in Place (multi-media)	UA2: Consolidate into Existing Landfill	FCW4: Consolidate into Existing Landfill	SP4: Cap in Place with Hydraulic Controls	GW2: Ground-water Controls with Limited Treatment
	Alternative 5	LF2: Cap in Place (multi-media)	UA2: Consolidate into Existing Landfill	FCW4: Consolidate into Existing Landfill	SP2: Consolidate into Existing Landfill	GW2: Ground-water Controls with Limited Treatment
	Alternative 6	LF3: Consolidate into New On-site RCRA Landfill	UA4: Consolidate into New On-site RCRA Landfill	FCW3: Consolidate into New On-site RCRA Landfill	SP6: Consolidate into New On-site RCRA Landfill	GW2: Ground-water Controls with Limited Treatment
Containment with Treatment Alternatives	Alternative 7	LF2: Cap in Place (multi-media)	UA2: Consolidate into Existing Landfill	FCW4: Consolidate into Existing Landfill	SP2: Consolidate into Existing Landfill	GW3 Ground-water Recovery and Treatment
	Alternative 8	LF3: Consolidate into New On-site RCRA Landfill	UA4: Consolidate into New On-site RCRA Landfill	FCW3: Consolidate into New On-site RCRA Landfill	SP6: Consolidate into New On-site RCRA Landfill	GW3: Ground-water Recovery and Treatment
	Alternative 9	LF2: Cap in Place (multi-media)	UA2: Consolidate into Existing Landfill	FCW4: Consolidate into Existing Landfill	SP3: Stabilization in Place	GW3: Ground-water Recovery and Treatment
Treatment Alternatives	Alternative 10	LF6: Incineration	UA6: Incineration	FCW5: Incineration	SP5: Stabilization in Place	GW3: Ground-water Recovery and Treatment

Evaluation Criteria

Nine factors were be considered in evaluating the Final Candidate Alternatives:

- Long-term effectiveness and permanence;
- Reduction in toxicity, mobility, or volume;
- Short-term effectiveness;
- Implementability;
- Cost;
- Overall protection of human health and the environment;
- Compliance with applicable or relevant and appropriate requirements (ARARs) that are shown in Appendix A;
- State acceptance; and
- Community acceptance.

The process begins by applying the protectiveness and ARAR factors to each of the candidate alternatives. Alternatives that do not satisfy these requirements will be screened out. Then a cost effectiveness screening is done to ensure that each of the alternatives would be a cost effective solution to the problems at the site. Finally, for the remaining alternatives which have passed these screening steps, all of the factors are weighed in determining the best overall solution to be applied at this site.

Screening of Alternatives

Potential ARARs and TBCs

Table 2 and Appendix A lists the potential ARARs and federal and state standards to be considered in selecting a remedy for this site.

Listing of Cathodic Waste. On September 13, 1988 EPA listed spent aluminum potliners from primary aluminum production as hazardous waste (EPA HW # K088). The effect of this listing on the evaluation of alternatives will be to change the status of certain of the RCRA potential ARARs from Relevant and Appropriate to those which are legally applicable in instances where materials at the site involve spent potliners.

The agency is also undertaking a Land Disposal Restriction Rulemaking that will specifically apply to soil and debris. Until that rulemaking is completed, the CERCLA program will not consider LDR to be relevant and appropriate to soil and debris that does not contain RCRA wastes.

Alternative 1

This alternative fails the protectiveness screen for the following reasons:

- The alternatives rely heavily on institutional controls and monitoring for the protection of public health and the environment.
- Uncontrolled wastes would be left in place on site.
- Continued migration of site contaminants into the groundwater aquifers will occur.
- The alternatives fail to meet ARARs identified in Table 2.

Alternative 2

This alternative is not considered to be adequately protective because it involves only an asphalt cap over the landfill. Since the landfill has been identified as a potential source of leachate, the use of a cap that relied only on the integrity of an asphalt coating was not considered to offer long term protection of public health and the environment.

Screening for Cost Effectiveness

The alternatives which pass initial screening are 3 through 10. These are then evaluated to determine if any one fails to provide for a solution that is cost effective. A summary of the cost effectiveness evaluation for these alternatives in shown in Table 5.

Based on the analysis shown in Table 5, Alternatives 6, 8 and 10 are determined to be not cost effective. The RCRA landfill included in Alternatives 6 and 8 is considered to provide a similar level of protection as a cap at this site, considering the basalt material on which the wastes sit. It is therefore not considered cost effective compared to alternatives 3, 4 or 5. Alternative 10, although providing the greatest level of treatment, is also not considered cost effective in light of the protectiveness provided by Alternatives 3, 4 or 5.

Alternatives 3, 4, 5, 7 and 9 are determined to be cost effective ones. Each of these alternatives appear to provide a level of effectiveness and reduction in toxicity, mobility, or volume (both criteria evaluated together) that is commensurate with the cost. These alternatives are evaluated in detail against the nine evaluation criteria in the following section.

Alternatives Evaluated

Alternative	Cost	Effectiveness	Reduction in Toxicity, Mobility or Volume
3	$6,700,000	Minimizes risks via containment	Limited gw treatment reduces volume of fluoride contamination
4	$10,900,000	Containment is similar to Alt 3	Limited gw treatment reduces volume of fluoride contamination
5	$10,800,000	Full consolidation minimizes area, similar level of containment	Limited gw treatment reduces volume of fluoride contamination
6	$20,000,000	Containment of RCRA landfill similar to cap in this instance	Limited gw treatment reduces volume of fluoride contamination
7	$11,900,000	Full consolidation minimizes area provides similar containment	Full gw treatment further reduces volume of fluoride contamination
8	$21,300,000	Containment in RCRA landfill similar to cap in this instance	Full gw treatment further reduces volume of fluoride contamination
9	$16,200,000	Containment and Solidification of SSPs	Solidification reduces mobility of fluorides
10	$40,300,000	Potential exposure minimized by destruction of contaminants	Incineration minimizes long term management of wastes

Alternative 3 Evaluation

Remedial Alternative 3 includes the following actions:

- Consolidation of the residual cathode waste material and underlying fill material from the Former Cathode Waste Management Areas into the existing Landfill;
- Consolidation of the cathode waste material from the Unloading Area into the existing Landfill;
- Capping the existing Landfill in place with a multi-media cap meeting RCRA performance standards;
- Placing a soil cover over Scrubber Sludge Ponds 2 and 3;
- Plug and abandon nearby production wells and connect users to the City of The Dalles water supply system;
- Collection and treatment of leachate generated from the Landfill and perched water east of River Road and from the Former Cathode Waste Management Areas;
- Recovery of groundwater from the Unloading Area;
- Institutional controls such as access and deed restrictions; and
- Groundwater quality monitoring and a contingency plan to recover and treat additional groundwater if further contamination in the A or B-aquifers is detected.

Short-Term Effectiveness

Implementation of Remedial Alternative 3 should reduce risks to the community and would pose minimal threats to on-site construction workers. The only potential risks to on-site workers would result from handling the waste materials from the Unloading Area, Former Cathode Waste Management Areas and Landfill during remediation. However, the use of dust controls, protective clothing and respiratory protection and by implementing a health and safety plan during remediation should greatly reduce the risks. Remedial Alternative 3 would take less than two years to implement upon initiation of remedial actions.

Reduction of Toxicity, Mobility or Volume

Remedial Alternative 3 treats the leachate generated from the Landfill, perched water collected east of River Road and from the Former Cathode Waste Management Areas which reduces the toxicity of these waste streams. However, the contaminated soils, sediments and waste materials remaining at the Landfill and Scrubber Sludge Ponds are not treated.

Implementability

The technologies associated with Remedial Alternative 3 are implementable at the MMRF. Potential fugitive dust emissions may result from waste handling activities at the Landfill, Former Cathode Waste Management Areas and Unloading Area. However, dust suppressants would be utilized to minimize dust generation.

Implementation of this remedial alternative requires the establishment of an ACL for fluoride and sulfate ARARs in the groundwater as presented in Section V. This alternative also requires the approval of institutional controls to prevent the use of potentially affected groundwater on site. Deed restrictions must also be approved to prevent future development on the waste disposal areas.

The equipment, materials, specialists and work force necessary to implement this remedial alternative are available. Also, the technologies associated with this alternative have been proven at other waste sites and could be implemented at the MMRF. A bench scale study would be required to evaluate the aqueous treatment system prior to the final design of the full scale system.

Compliance with ARARs

Remedial Alternative 3 meets all action and location specific and most chemical-specific ARARs for the areas of contamination. However, groundwater beneath the Landfill, Former Cathode Waste Management Areas, Scrubber Sludge Ponds and Recycle Pond will remain in excess of the ARARs for fluoride and sulfate. With the establishment of an ACL for the fluoride and sulfate ARARs, discussed in Section IV, Remedial Alternative 3 would meet all chemical-specific ARARs.

Overall Protection

Alternative 3 provides protection to the community of The Dalles, on-site workers and the environment. The risks at the MMRF would be reduced by containing the waste, recovering groundwater and treating affected leachate and perched water. Containment of the waste reduces the potential for direct contact with the waste as well as the generation of leachate and fugitive dust emissions. Recovery of groundwater and treatment of the leachate and perched water greatly minimizes the potential for off-site migration of contaminants. Thus, Remedial Alternative 3 effectively mitigates the exposure pathways identified for the target remediation areas.

Cost

The capital cost of Remedial Alternative 3 is $5,728,400. The annual O&M costs for years 1 through 5 will be $144,00. The annual O&M costs for years 6 through 30 will be $55,600. The total present worth value of this alternative using a discount rate of 8% is $6,707,400.

The capital cost of implementing a groundwater contingency plan in the A-aquifer would be $277,000. The annual O&M cost for this plan would be $48,000. The total present worth of this plan using a discount rate of 8% is $767,000.

The capital cost of implementing a ground water contingency plan in the B-aquifer would be $495,000. The annual O&M cost for this plan would be $55,000. The total present worth of this plan using a discount rate of 8% is $1,114,000.

Alternative 4 Evaluation

In addition to those actions that would be implemented under Alternative 3, Remedial Alternative 4 adds the following actions:

- Capping the Scrubber Sludge Ponds in place with a multi-media cap meeting RCRA performance standards and creating a hydraulic barrier to minimize contact between the waste and the groundwater;

Short-Term Effectiveness

Like Alternative 3, implementation of Remedial Alternative 4 should reduce risks to the community and would pose minimal threats to on-site construction workers. Remedial Alternative 4 would also take less than two years to implement upon initiation of remedial actions.

Long-Term Effectiveness

In addition to the long term effectiveness provided by Alternative 3, implementation of hydraulic controls around the Scrubber Sludge Ponds would lower the S-aquifer beneath the bottom of the ponds, thus reducing the potential for leaching of fluorides from the sludges.

Like Alternative 3, long-term maintenance would be required for the cap systems. The long term effectiveness of the hydraulic barriers is questionable in that they will require essentially permanent maintenance.

Reduction of Toxicity, Mobility or Volume

Like Alternative 3, Remedial Alternative 4 treats the leachate generated from the Landfill, perched water collected east of River Road and from the Former Cathode Waste Management Areas which reduces the toxicity, mobility and volume of these waste streams. However, the contaminated soils, sediments and waste materials remaining at the Landfill and Scrubber Sludge Ponds are not treated.

Implementability

As with Alternative 3, the technologies associated with Remedial Alternative 4 are implementable at the MMRF. Potential fugitive dust emissions may result, however, dust suppressants would be utilized to minimize dust generation.

Implementation of this remedial alternative requires the establishment of an ACL for fluoride and sulfate ARARs in the groundwater as presented in Section IV. This alternative also requires the approval of institutional controls to prevent the use of potentially affected groundwater on site. Deed restrictions must also be approved to prevent future development on the waste disposal areas.

The equipment, materials, specialists and work force necessary to implement this remedial alternative are available. Also, the technologies associated with this alternative have been proven at other waste sites and could be implemented at the MMRF. A bench scale study would be required to evaluate the aqueous treatment system prior to the final design of the full scale system. The hydraulic barriers would require permanent maintenance, however.

Compliance with ARARs

Remedial Alternative 4 meets all action and location specific and most chemical-specific ARARs for the areas of contamination. However, groundwater beneath the Landfill, Former Cathode Waste Management Areas, Scrubber Sludge Ponds, and Recycle Pond wil remain in excess of the ARARs for fluoride and sulfate. With the development of an ACL for the fluoride and sulfate ARARs, discussed in Section IV, Remedial Alternative 4 would meet all chemical-specific ARARs.

Overall Protection

Alternative 4 provides protection to the community of The Dalles, on-site workers and the environment similar to that provided in Alternative 3. In addition, this alternative would also reduce future leaching of fluoride from waste in the Scrubber Sludge Ponds.

Cost

The capital cost of Remedial Alternative 4 is $9,229,100. The annual O&M costs for years 1 through 5 will be $207,600. The annual O&M costs for years 6 through 30 will be $119,000. The total present worth value of this alternative using a discount rate of 8% is $10,922,600.

Alternative 5 Evaluation

In addition to the remedial actions contained in Alternative 3, Remedial Alternative 5 adds the following actions:

- Consolidation of the scrubber sludge material and underlying soils from Scrubber Sludge Ponds 1 through 4 into the existing Landfill;

Short-Term Effectiveness

Implementation of Remedial Alternative 5 would pose more potential short term on-site risk than Alternative 3 due to the movement of material from the scrubber sludge ponds to the landfill. It is expected that implementation of this remedial alternative would take approximately two years, somewhat longer than either Alternative 3 or 4.

Long-Term Effectiveness

Like Alternatives 3 and 4, Alternative 5 would effectively mitigate the existing risks associated with direct contact with contaminated perched water, leachate and/or waste. In addition to those areas covered in Alternative 3, waste material from the Scrubber Sludge Ponds will be removed, reducing any existing or future risks from these areas.

As with Alternatives 3 and 4, the overall potential for failure of the Landfill cap is minimal, given the environment that the cap and cover will be used in.

Reduction of Toxicity, Mobility or Volume

Like Alternatives 3 and 4, Remedial Alternative 5 treats the leachate generated from the Landfill and Former Cathode Waste Management Areas which reduces the toxicity, mobility and volume of these waste streams. However, the contaminated soils, sediments and waste materials remaining in the Landfill after capping are not treated.

Implementability

Like Alternatives 3 and 4 the equipment, materials, specialists and work force necessary to implement this remedial alternative are available.

Compliance with ARARs

Like Alternatives 3 and 4, Remedial Alternative 5 meets all action and location specific and most chemical-specific ARARs for the areas of contamination. However, groundwater beneath the Landfill, Former Cathode Waste Management Areas, Scrubber Sludge Ponds and Recycle Pond wil remain in excess of the ARARs for fluoride and sulfate. With the establishment of an ACL for the fluoride and sulfate ARARs, discussed in Section IV, Remedial Alternative 5 would meet all chemical-specific ARARs.

Overall Protection

Remedial Alternative 5 provides protection to the community of The Dalles, on-site workers and the environment similar to that provided in Alternatives 3 and 4. In addition, the potential for leachate generation at the scrubber sludge ponds is reduced under this alternative.

Cost

The capital cost of Remedial Alternative 5 is $9,807,100. The annual O&M costs for years 1 through 5 will be $146,000. The annual O&M costs for years 6 through 30 will be $57,400. The total present worth value of this alternative using a discount rate of 8% is $10,807,100.

Alternative 7 Evaluation

In addition to the remedial actions contained in Alternative 3, Remedial Alternative 7 consists of the following actions:

- Consolidation of the Scrubber Sludge material and underlying fill from Scrubber Sludge Ponds 1 through 4 into the existing Landfill rather than placing a soil cover over Scrubber Sludge Ponds 2 and 3;

- Groundwater recovery and treatment for all areas which exceed ARARs, in addition to the Unloading Area;

Short-Term Effectiveness

Like Alternative 5, implementation of Remedial Alternative 7 would pose more potential short term on-site risk than Alternative 3 due to the movement of material from the scrubber sludge ponds to the landfill. It is expected that implementation of this remedial alternative would take approximately two years, somewhat longer than either Alternative 3 or 4.

Long-Term Effectiveness

Like Alternatives 3 to 5, Alternative 7 would effectively mitigate the existing risks associated with direct contact with contaminated perched water, leachate and/or waste. In addition to those areas covered in Alternative 3, waste material from the Scrubber Sludge Ponds will be removed, reducing any existing or future risks from these areas.

As with Alternatives 3 to 5, the overall potential for failure of the Landfill cap and soil cover over the Scrubber Sludge Ponds is minimal, given the environment that the cap will be used in.

Reduction of Toxicity, Mobility or Volume

In addition to those areas covered in Alternatives 3 through 5, Remedial Alternative 7 recovers groundwater from the Scrubber Sludge Ponds and Recycle Pond. The toxicity of these waste streams is therefore, greatly minimized. However, the contaminated soils, sediments and waste materials contained in the Landfill after capping are not treated.

Implementability

Like Alternatives 3 through 5, the technologies associated with Remedial Alternative 7 are implementable at the MMRF. Unlike these earlier alternatives, implementation of this remedial alternative would not require the establishment of an ACL for fluoride and sulfate ARARs.

Compliance with ARARs

Remedial Alternative 7 includes collection and treatment of the contaminated leachate, perched water and groundwater to meet remediation criteria prior to discharge. Remedial Alternative 7 would meet all applicable chemical specific, location specific and action specific ARARs.

Overall Protection

Remedial Alternative 7 provides protection to the community of The Dalles, on-site workers and the environment similar to that provided in Alternatives 3 through 5. In addition, the potential for groundwater contaminants migrating is minimized under this alternative.

Cost

The capital cost of Remedial Alternative 7 is $10,255,500. The annual O&M costs for years 1 through 5 will be $315,600. The annual O&M costs for years 6 through 30 will be $57,400. The total present worth value of this alternative using a discount rate of 8% is $11,932,600.

Alternative 9 Evaluation

In addition to the remedial actions contained in Alternative 3, Remedial Alternative 9 would add following actions:

- Stabilization of Scrubber Sludge Ponds 1 through 4 and covering the stabilized material;

- Groundwater recovery and treatment for all areas which exceed ARARs, in addition to the Unloading Area;

Short-Term Effectiveness

Like Alternatives 5 and 7, implementation of Remedial Alternative 9 would pose more potential short term risk on-site than Alternative 3 due to the movement of material during the solidification process. It is expected that implementation of this remedial alternative would take approximately two years, somewhat longer than either Alternative 3 or 4.

Long-Term Effectiveness

Like Alternatives 3 to 5, Alternative 9 would effectively mitigate the existing risks associated with direct contact with contaminated perched water, leachate and/or waste. In addition to those areas covered in Alternative 3, waste material from the Scrubber Sludge Ponds will be stabilized, reducing any existing or future generation of leachate.

The cap installed on the Landfill would effectively reduce leachate generation and isolate the waste, including that from the Scrubber Sludge Ponds, from direct contact with humans or wildlife. Groundwater treatment will be applied in all areas that exceed ARARs, eliminating the need for establishing an ACL.

Reduction of Toxicity, Mobility or Volume

In addition to those areas covered in alternatives 3 through 5, Remedial Alternative 9 recovers groundwater from the Scrubber Sludge Ponds and Recycle Pond. The toxicity of these waste streams is therefore, greatly minimized. In addition, the contaminated soils in the scrubber sludge ponds are stabilized, reducing their mobility.

Implementability

Like Alternatives 3 through 5, the technologies associated with Remedial Alternative 9 are implementable at the MMRF. Potential fugitive dust emissions may result from waste handling activities, including those at the Scrubber Sludge Ponds for this alternative.

Unlike these earlier alternatives, implementation of this remedial alternative would not require the establishment of an ACL for fluoride and sulfate ARARs.

The equipment, materials, specialists and work force necessary to implement this remedial alternative are available. Also, the technologies associated with this alternative have been proven at other waste sites and could be implemented at the MMRF. A bench scale study would be required to evaluate the aqueous treatment system prior to the final design of the full scale system. An additional study would be required to identify the proper mix for stabilization of the scrubber sludge ponds.

Compliance with ARARs

Like Alternative 7, Remedial Alternative 9 would also meet applicable chemical specific, location-specific and action-specific ARARs without requiring the establishment of an ACL.

Overall Protection

Like Alternative 7, Remedial Alternative 9 provides protection to the community of The Dalles, on-site workers and the environment similar to that provided in Alternatives 3 through 5. In addition, the potential for groundwater contaminants migrating is minimized under this alternative.

Costs

The capital cost of Remedial Alternative 9 is $14,530,700. The annual O&M costs for years 1 through 5 will be $312,000. The annual O&M costs for years 6 through 30 will be $53,800. The total present worth value of this alternative using a discount rate of 8% is $16,167,400.

Evaluation of Alternatives Against State Acceptance Criteria

The State of Oregon has expressed support for Alternative 3 as opposed to the other Alternatives evaluated.

Evaluation of Alternatives Against Community Acceptance Criterion

Based on the lack of community response during the public comment period, EPA has determined that the community supports Alternative 3 as being the preferred alternative for remedying the risks at the site.

VI SELECTED ALTERNATIVE

Description of Selected Remedy

The selected remedy is based on Alternative 3 and comprises the following:

- Consolidate the residual cathode waste material and underlying fill material from the Former Cathode Waste Management Areas into the existing Landfill;
- Consolidate the cathode waste material from the Unloading Area into the existing Landfill;
- Cap the existing Landfill in place with a multi-media cap meeting RCRA performance standards;
- Place a soil cover over Scrubber Sludge Ponds 2 and 3;
- Plug and abandon nearby production wells and connect users to the City of The Dalles water supply system;
- Collect and treat leachate generated from the Landfill and perched water east of River Road and from the Former Cathode Waste Management Areas;
- Recover and treat contaminated groundwater from the Unloading Area;
- Groundwater quality monitoring and a contingency plan to perform additional recovery of groundwater in the event that further contamination is detected above ARARs or health based standards.

Institutional controls such as deed restrictions and fencing will be implemented during and after remediation. The purpose of these controls will be to assure that the remedial action will protect public health and the environment during its execution, and to ensure a similar level of protection after the remedial actions have been implemented.

Consolidation into Landfill. The Landfill and associated areas will be consolidated to limit the actual lateral extent of the cap. The Unloading Area and Former Cathode Waste Management Areas will be excavated down to competent basalt and consolidated into the existing Landfill. Leachate will be collected after capping the Landfill. Perched water, beneath the Former Cathode Waste Management Areas will be collected during excavation activities and treated. This should be effective in collecting perched water on both sides of River Road. However, temporary sump(s) may be necessary to collect perched water east of River Road if the collection pumps in the Cathods Waste management Areas are not effective. A soil cover will be placed over Scrubber Sludge Ponds 2 and 3. Groundwater controls will consist of institutional controls and limited groundwater recovery. Dust controls will be utilized during remediation to minimize fugitive dust emissions. Fencing and deed restrictions will be utilized to limit access and prevent future use of areas where materials are managed on-site. Only authorized personnel would be allowed entry to the Landfill and Scrubber Sludge Ponds after remediation is complete.

The Unloading Area will be excavated resulting in the removal of approximately 200 cubic yards of cathode waste residuals and placement into the existing Landfill prior to its capping. Backfilling will be performed to promote drainage.

The cathode waste residuals and underlying soils from the Former Cathode Waste Management Areas will be excavated and placed into the existing Landfill prior to capping the Landfill. The Former Cathode Waste Management Areas will be excavated down to competent basalt resulting in a total volume of material removed of 64,470 cubic yards. The excavation for the Bath Recovery Pad Area will also remove the cathode waste materials along the Landfill Ditch. After removal activities have been completed, the Former Cathode Waste Management Areas will be backfilled as required to promote drainage. Capping will not be required because cathode waste residuals and subsoils from the Former Cathode Waste Management Areas will be removed and placed into the Landfill for management. The perched water will be collected during remedial activities and treated for cyanide and fluoride by the aqueous treatment system. Long-term collection and treatment of perched water will not be required because materials from the Former Cathode Waste Management Areas will be removed and placed in the Landfill.

Landfill Cap. The Landfill will be covered with a multi-media cap meeting the performance standards as defined in 40 CFR 264.310 after consolidating materials from the Unloading Area and the Former Cathode Waste Management Areas. The volumes of material estimated to be removed and consolidated from each area are presented below:

- Unloading Area 200 cubic yards
- Potliner Handling Area 9,910 cubic yards
- Old Cathode Waste Pile Area 24,200 cubic yards
- Salvage Area 28,700 cubic yards
- Bath Recovery Pad Area 1,660 cubic yards

The total volume of additional material from these areas (64,670 cubic yards) will not alter the overall lateral extent of the cap as illustrated in Figure 4. However, the overall finished elevation will be increased to accommodate the additional fill.

Regrading of the Landfill into a central location will be performed to minimize the areal extent of the cap to approximately 10 acres as illustrated in Figure 5. This activity will include the remediation of the Leachate Collection, Landfill and Surface Drainage Ditches by consolidating material contained in the areas under the cap for the Landfill. The known asbestos disposal areas shall not be disturbed during the regrading activities but will have the RCRA performance cap over them.

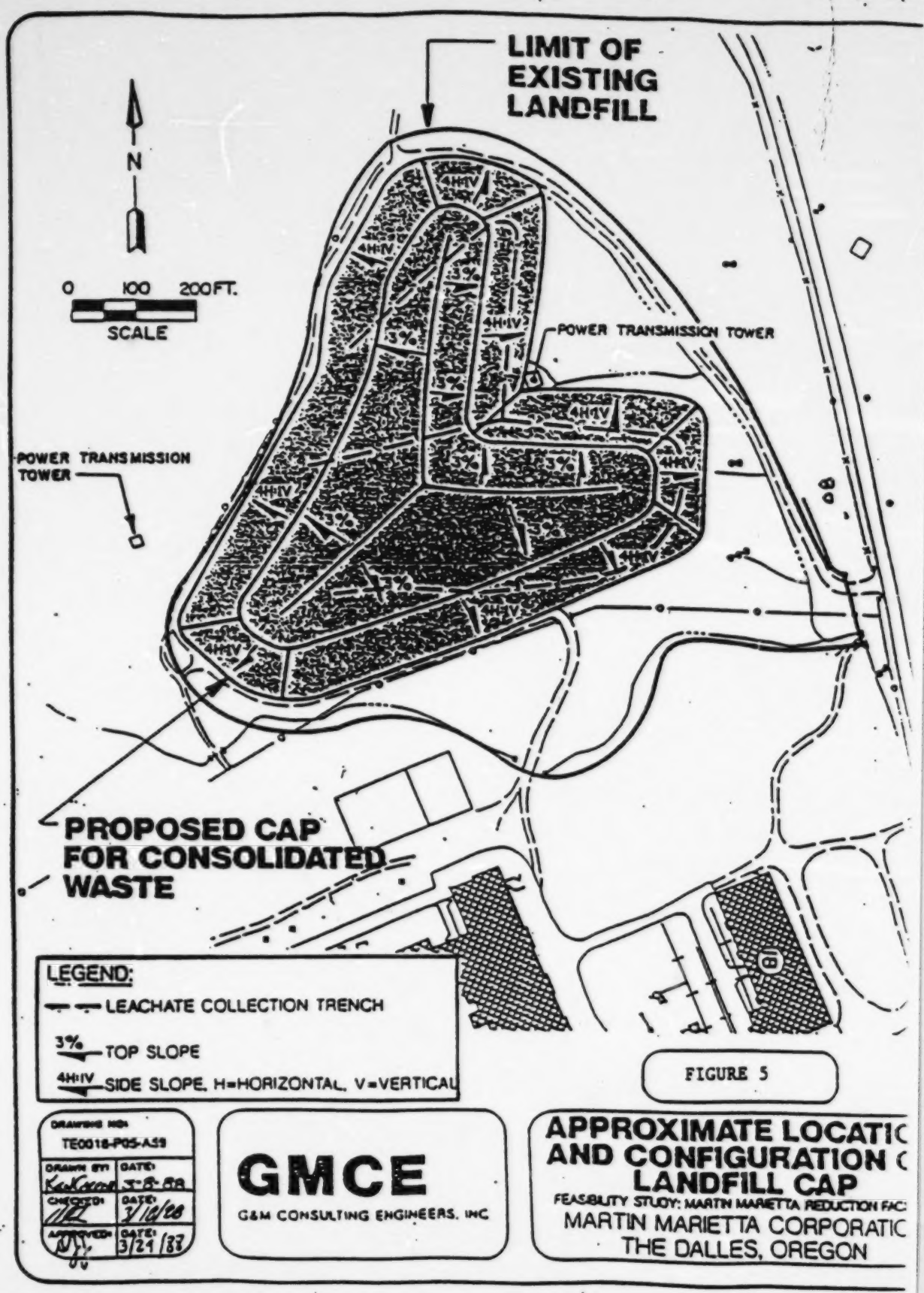

FIGURE 5

DRAWING NO: TE0018-P05-A59	
DRAWN BY: KenKarnes	DATE: 3-8-88
CHECKED:	DATE: 3/10/88
APPROVED:	DATE: 3/21/88

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APPROXIMATE LOCATIC AND CONFIGURATION C LANDFILL CAP

FEASIBILITY STUDY: MARTIN MARIETTA REDUCTION FAC

MARTIN MARIETTA CORPORATIC

THE DALLES, OREGON

The cover system will be a multi-media cap designed to meet RCRA performance standards. The multi-media cap shown in Figure 6 would consist of a rock cover, a geotextile layer, 6-inches of clean sand, a wire mesh for rodent control, another 6-inches of clean sand, a HDPE geomembrane, a lower layer of low permeability soil or clay material, and 6-inches of clean sand overlying the waste which will serve as part of a passive gas venting system. The piping for the gas venting will be constructed of HDPE for compatibility with the geomembrane in the cap. The top and side slopes of the cap will be constructed as to minimize erosion and the drainage controls around the Landfill would be improved to redirect surface water runoff.

Leachate collection trenches will be constructed to intercept the flow of leachate utilizing the historical surface drainage pathways prior to capping the Landfill. These trenches will be placed such that once the cap is constructed, they are located under the cap and will only collect leachate generated from the wastes after capping. Depending on the grade of the subsurface topography, collection sumps may be necessary to transmit the collected leachate to a central location. The collected leachate will be pumped to an on-site aqueous treatment system for cyanide and fluoride removal. The MMRF is located in an arid region and because of this climate, a moisture deficit of approximately 15 inches per year exists. Therefore, it is anticipated that the leachate generated from the Landfill after being capped will gradually decrease from its existing average annual flowrate of approximately 10 gpm to a negligible flow within five years.

The on-site aqueous treatment system would include a chemical oxidation unit for destruction of cyanide followed by a chemical precipitation unit to remove fluoride to an approximate concentration of 9.7 mg/L. A schematic of the aqueous treatment system is shown in Figure 7. The treatment plant will be located between the Cathode Wash Area and River Road. Effluent from the aqueous treatment system will be discharged to an existing sewer which flows to the Discharge Channel and ultimately to the Recycle Pond.

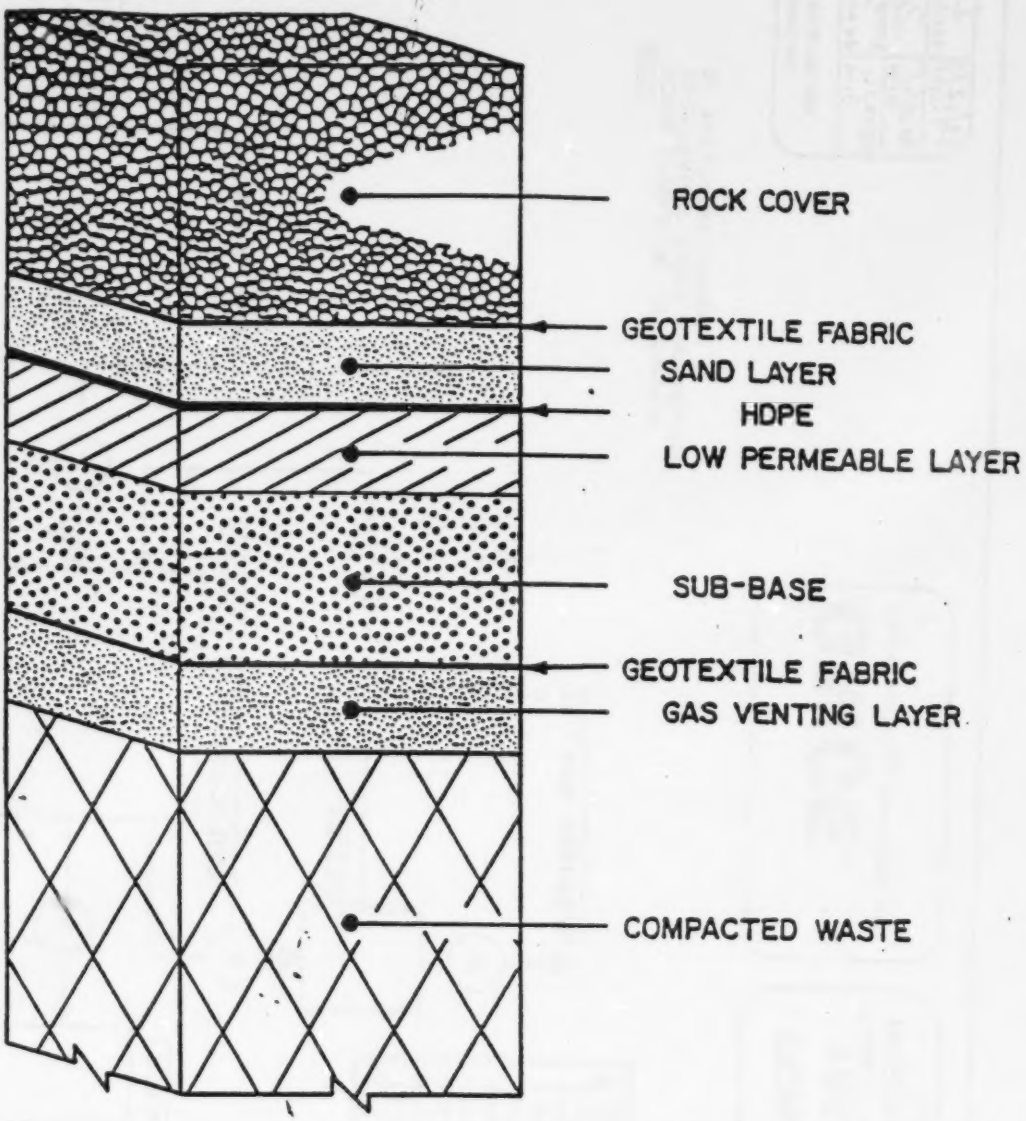

FIGURE 6

DRAWING NO: TE0018-PO3-A103	
DRAWN BY: Ken Carroll	DATE: 9-16-88
CHECKED: DH	DATE: 9-16-88
APPROVED: D. Jump	DATE: 9-16-88

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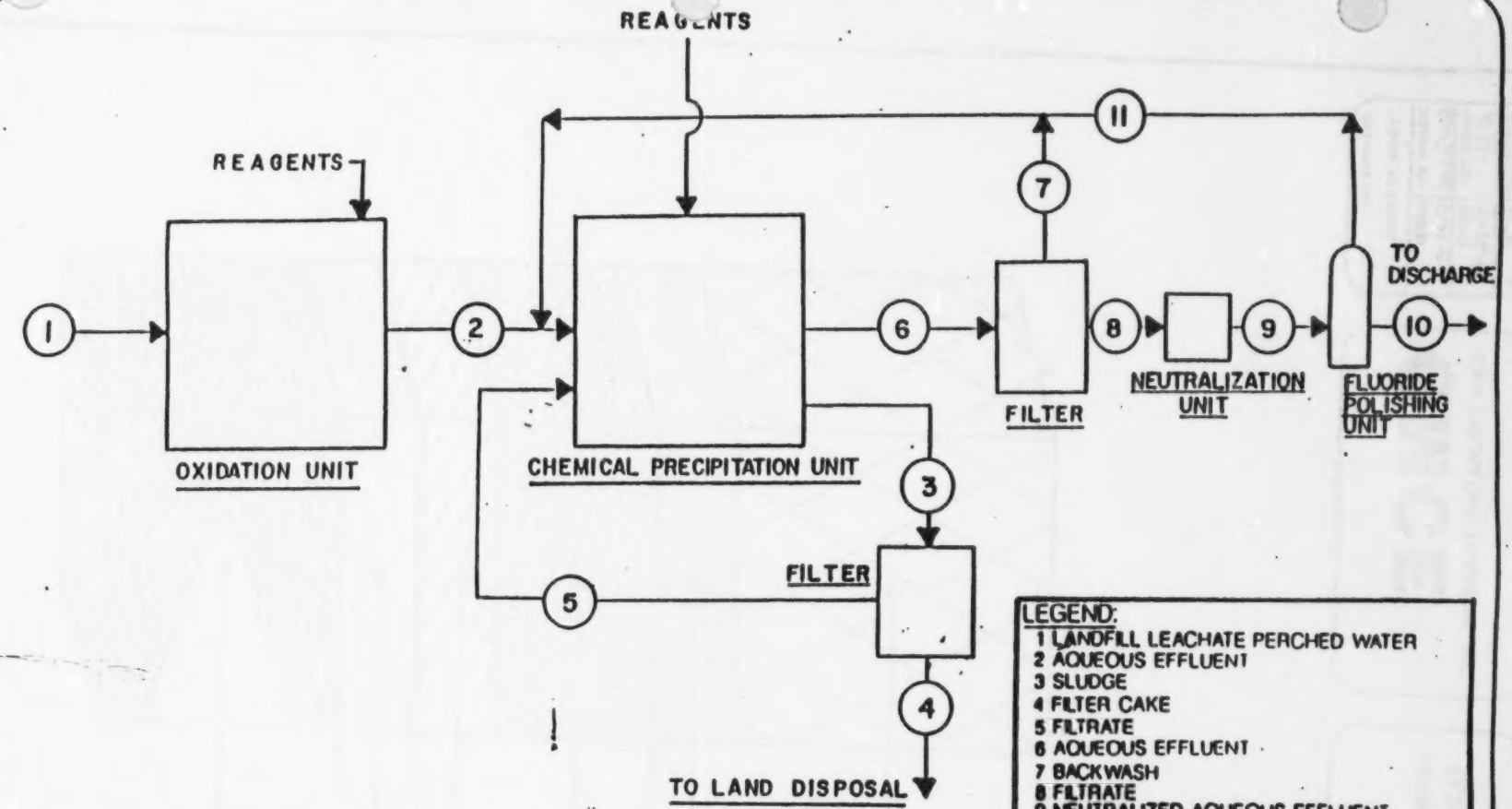
PROPOSED CAP CROSS SECTION

FEASIBILITY STUDY: MARTIN MARIETTA REDUCTION FACILITY

MARTIN MARIETTA CORPORATION
THE DALLES, OREGON



NOTE:
BENCH STUDIES WILL BE REQUIRED TO DETERMINE EXACT CONFIGURATION OF TREATMENT SYSTEM.

FIGURE 7

DRAWING NO: TE0018-P05-A85

DRAWN BY:	DATE: 11/10/87
CHECKED:	DATE: 3-15-88
APPROVED:	DATE: 3/29/88

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SCHEMATIC AQUEOUS TREATMENT SYSTEM

FEASIBILITY STUDY: MARTIN MARIETTA REDUCTION FACILITY
MARTIN MARIETTA CORPORATION
THE DALLES, OREGON

Recovery of perched water east of River Road will be limited to a one time extraction during remedial activities. The use of the roof scrubber return line beneath the former Cathode Waste Management Areas would require temporary disruption of flows to relocate the line or replace it during remedial activities. Any damaged lines will be repaired as part of this process.

Scrubber Sludge Ponds Cover. The Selected Remedy involves covering Scrubber Sludge Ponds 2 and 3 with a soil cover. A cross-section of the proposed cover system is illustrated in Figure 8. The soil cover consists of two feet of soil and a vegetative cover placed on the Scrubber Sludge Pond sludge. The top and side slopes of the cover system will be constructed to minimize erosion. Drainage controls will be installed or improved as necessary to redirect surface-water runoff. Scrubber Sludge Ponds 1 and 4 are already covered with established vegetation and do not require additional efforts under this alternative.

Groundwater Recovery. With the establishment of an ACL for the fluoride and sulfate ARARs, groundwater recovery and treatment are currently proposed at the Unloading Area. To recover groundwater from the Unloading Area, a 4-inch diameter recovery well will be installed in the area of monitor well 5S as shown in Figure 9. This recovery well, RW-1, will be equipped with a submersible pump which will be operated at a continuous flowrate of 2 gpm. It is expected that recovery from RW-1 would continue for approximately five years. Recovered groundwater from RW-1 will be discharged into the Recycle Pond where it will be recycled to the roof scrubbers or treated by the in plant process, which is designed to reduce fluoride levels.

Well Abandonment. The selected remedy also includes replacement of the existing Animal Shelter, Rockline, Klindt and Residence wells with water from the City of The Dalles water supply system and properly abandoning the existing wells at these locations.

Groundwater Monitoring

Groundwater monitoring would be conducted to monitor variations in groundwater quality and would serve as the basis for monitoring remediation effectiveness and initiating future actions if required. Table 6 presents the monitoring wells and the associated target areas that, at a minimum, will be part of the monitoring plan.

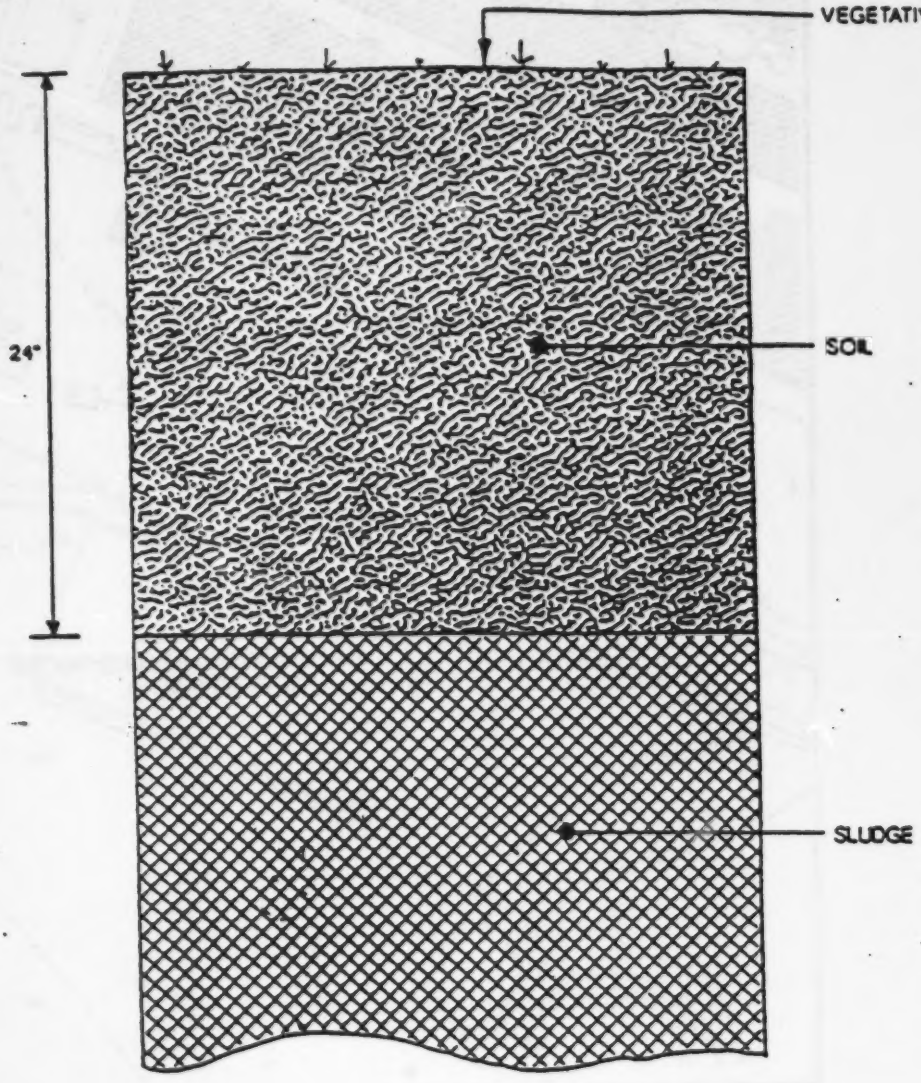

FIGURE 8

DRAWING NO: TE0018-P05-AS2	
DRAWN BY: KC	DATE: 7-25-88
CHECKED: KC	DATE: 3-29-88
APPROVED: DJF	DATE: 3/29/88

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SOIL COVER SYSTEM CROSS-SECTION
FEASIBILITY STUDY: MARTIN MARIETTA REDUCTION FACILITY
MARTIN MARIETTA CORPORATION
THE DALLES, OREGON

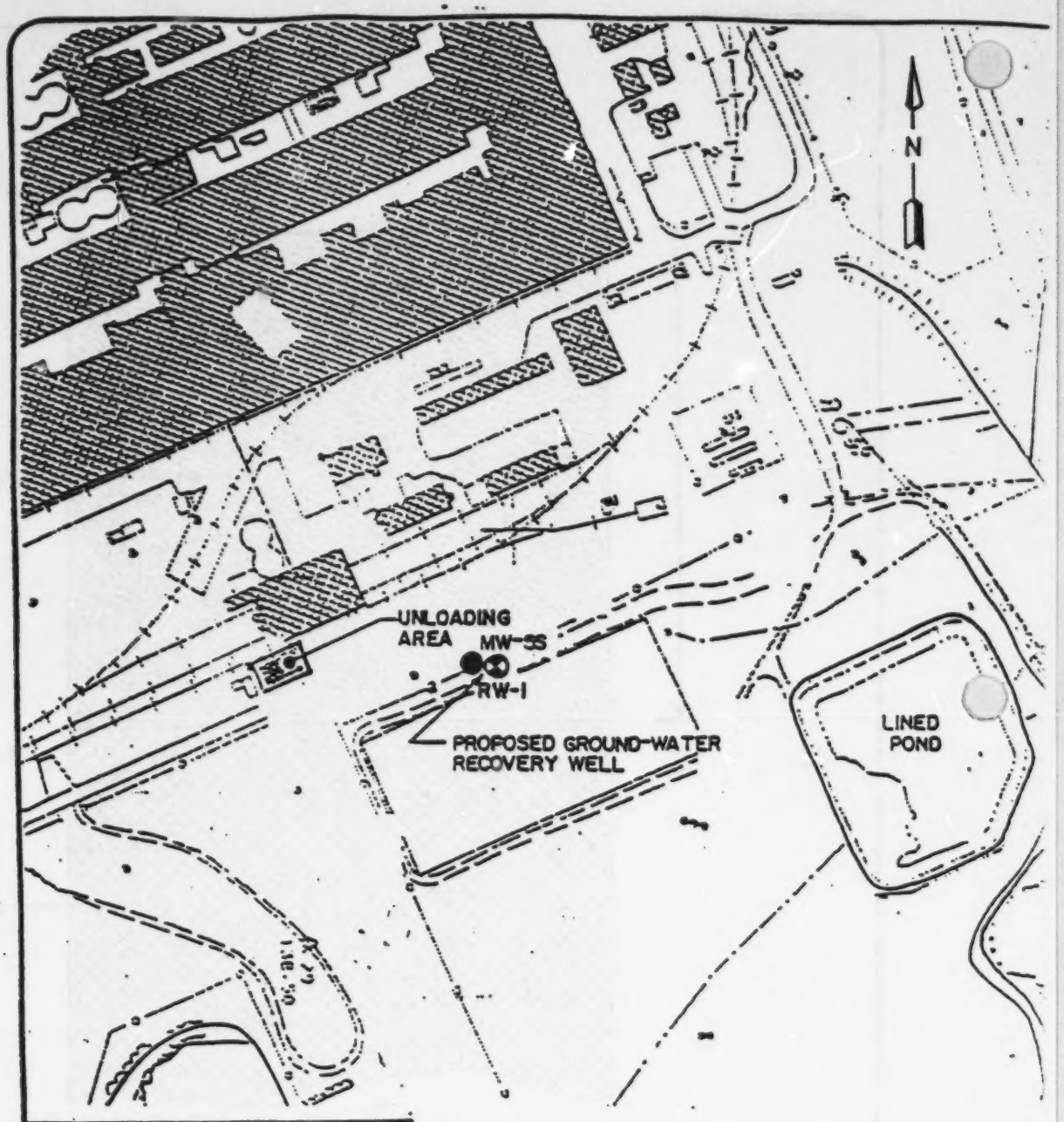

FIGURE 9

DRAWING NO: TE0018-P05-A61	
DRAWN BY: S.K.F.	DATE: 3/10/82
CHECKED: TLC	DATE: 3-10-82
APPROVED: OK CW	DATE: 3/24/82

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UNLOADING AREA RECOVERY WELL
FEASIBILITY STUDY: MARTIN MARIETTA REDUCTION FA
MARTIN MARIETTA CORPORATION
THE DALLES, OREGON

TABLE 6

GROUNDWATER MONITORING WELLS

MARTIN MARIETTA REDUCTION FACILITY
THE DALLES, OREGON

Aquifer System	Wells to be Monitored
S	2S, 5S, 8S, 9S, 15S, 17S, 18S, 19S, 21S, 24S, 26S, 27S, 29S,
A	1A, 4A, 6AA, 7A, 8A, 9A, 10A, 12A, 13A, 14A, 15A, 27A, 30S, 33A
B	1B, 3A, 8B, 9B, 12B, 14B, 18A, 26B, 27B, 33B, 34A
DGWR	PW-1
Other	Chenoweth Irrigation 1, 2, and 3

Contingency Plan. The following plan would be implemented if the groundwater monitoring program indicates that appropriate ARARs or remediation criteria are exceeded. Different scenarios exists which would require groundwater response actions. These include: 1) contamination above an ARAR or other remediation criteria in the A-aquifer beneath the Landfill; and 2) contamination above an ARAR or other remediation criteria in the B-aquifer beneath the Landfill. Should an ARAR or other remediation criteria be exceeded in both the A- and B-aquifers, the response actions for both scenarios would be conducted simultaneously.

A-Aquifer Response Plan. It is anticipated that recovery of groundwater could be conducted by installing two four-inch diameter recovery wells downgradient of the Landfill. It has been estimated that each well would be pumped at a continuous flowrate of 20 gpm for a total recovery rate of 40 gpm. The recovered groundwater would be transmitted to a treatment unit and then routed to the roof scrubber system or sent to the in-plant process.

B-Aquifer Response Plan. The recovery system here would be constructed by installing three four-inch diameter recovery wells in the B-aquifer downgradient of the Landfill. The recovery wells would be operated at a continuous flowrate of approximately 100 gpm for a combined flowrate of 300 gpm. The recovered groundwater would be transmitted to a treatment unit and would then be routed to the roof scrubber system or sent to the in-plant process.

Institutional Controls

Institutional controls such as deed restrictions or fencing will be established on-site to prevent the installation of wells that draw water from the S Aquifer. Institutional controls will also be used as appropriate during implementation of the selected remedy to ensure that remedial actions are protective of public health and the environment.

Performance Standards

Capping - The Landfill cap shall be designed and maintained to provide protection against surface exposure of humans or animal or plant life to the stabilized soil contaminants, and protect this material from weathering. A four inch soil cover will be placed over the Scrubber Sludge Ponds 2 and 3 and revegetated.

The Landfill cap must also meet the following design requirements of 40 CFR 264.310.a: 1) function with minimum maintenance; 2) promote drainage; and 3) accommodate settling and subsidence so that the cap's integrity is maintained.

The performance standard for groundwater treated for fluoride contamination shall be 9.7 mg/l.

The remediation criteria that shall be used to determine the volumes of soils to be remediated are as follows:

Criteria	Basis
Arsenic - 65 mg/kg	Carcinigenic Risk
PAHs - 175 mg/kg	Urban Background
Fluoride - 2,200 mg/kg	Protection of Groundwater

Statutory Determinations

A. The Selected Remedy is Protective of Human Health and the Environment

The remedy at this site will permanently reduce the risks presently posed to human health and the environment by:

* Preventing exposure to contaminated soils by consolidation and capping of areas where direct exposure risks were identified, and

* Minimizing the generation of leachate from the landfill by the use of a RCRA cap

* Institutional controls such as deed restrictions and fencing to prevent exposure to contaminated soils and groundwater.

B. The Selected Remedy Attains ARARs

With the establishment of ACLs for fluoride and sulfate in the S Aquifer at the site, the implementation of this remedy will attain all applicable or relevant and appropriate federal and state requirements that apply to the site. These are summarized in Appendix A. A summary of key ARARs follows:

The proposed remediation at the site will attain the general RCRA closure performance standards as specified in 40 CFR §264.111

A groundwater monitoring system will be implemented consistent with 40 CFR 264.100(d) to determine the effectiveness of the remedy at the site.

C. The Selected Remedial Action is Cost Effective

Given the nature of the risks at the site, Alternative 3 provides an equal measure of effectivenesss compared to the other more costly alternatives, which are also determined to be protective. The selected remedy is therefore determined to provide a level of protection in a manner that is cost effective.

D. The Selected Remedy Utilizes Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies the the Maximum Extent Practicable.

The selected remedy provides groundwater treatment for those areas where it is considered practicable, taking into account the nine evaluation criteria.

E. Satisfying the Preference for Treatment as a Principle Element.

The principal element of the selected remedy involves capping and consolidation of areas of contamination. Although this does not satisfy the preference for treatment as a principal element, the remedy does adress the principal health threats at the site. Treatment of contaminated soils at the site was not found to be practicable given the nature of the risks involved and the protectiveness of the selected remedy. Treatment of contaminated groundwater is included in the selected remedy.

APPENDIX A
POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
LAWS AND REGULATIONS TO BE CONSIDERED

A. FEDERAL LAWS AND REGULATIONS THAT ARE POTENTIAL ARARs FOR THE MARTIN MARIETTA SITE

- Resource Conservation and Recovery Act (RCRA) (42 USC 6901), Subtitle C:

  Landfills: must comply with 40 CFR 264 standards for a hazardous waste landfill.

  Capping: must comply with 40 CFR 264 Subpart G standards for a cover over hazardous waste at closure.

  Closure with waste in place; must comply with 40 CFR 264 Subpart G standards for closure performance and post-closure care and monitoring.

- Clean Air Act (CAA) (42 USC 7401):

  National Ambient Air Quality Standards for particulate matter and PM_{10} - Requirements are specified under Oregon ARARs.

- OSHA 29 CFR 1910:

  Regulations governing worker safety at hazardous waste sites.

- Safe Drinking Water Act (SWDW) (42 USC 300):
  Drinking Water Standards (40 CFR 141), including maximum contaminant levels (MCLs) for fluoride.

- Clean Water Act (CWA) (33 USC 1251):
  National Pollutant Discharge Elimination System (40 CFR 122)

B. OREGON STATE LAWS AND REGULATIONS THAT ARE POTENTIAL ARARs FOR THE MARTIN MARIETTA SITE

Chemical Specific ARARs

Regulation	Standard
OAR 333-61-030	1.0 mg/l Drinking Water Standard for barium 1.4 - 2.4 mg/l Drinking Water Standard for fluoride 250 mg/l Drinking Water Standard for sulfates 0.05 mg/l Drinking Water Standard for arsenic
OAR 437.100.010	No employee exposure to inorganic arsenic at concentrations greater than 10 ug/m3 of air averaged over any 8 hour period.
OAR 340-31.055	Ambient Air Quality Standard of1.5 ug/m3 lead. Arithmetic average concentration of all samples collected during any one calendar quarter period.

OAR 340.20.225	Air/ Significant Emission Rate of 3 tons/year fluoride
OAR 437.111.010	No employee exposure at lead concentrations greater than 50 ug./m^3 of air averaged over an 8-hour period.
OAR 340-45	Regulations Pertaining to NPDES and WPCF Permits

Suspended Particulate Matter

OAR 340-31.015

Annual Geometric Mean	60 ug/m3
24 hour concentration for more than 15% of samples in one calendar month.	100 ug/m3
24 hour concentration not more than once per year.	150 ug/m3

Fine Particulates/ PM10

Annual Arithmetic Average	50 ug/m3
24 hour average concentration, not exceeded more than average of one day per year.	150 ug/m3

Action Specific ARARs

Hazardous Waste

OAR 340.100-002

(Federal Regulations Incorporated by Reference)

Capping

surface impoundments - 40 CFR 264.228

waste piles - 40 CFR 264.258(b)

landfills - 40 CFR 264.310(a)

Closure with waste in place

stabilization - 40 CFR 264.228 (a)(2) and 40 CFR 264.258(b)

install final cover - 40 CFR 264.310

30 year post closure care - 40 CFR 264.310

Operation and Maintenance - 40 CFR 264.310

Surface Water Control - 40 CFR 264.251(c),(d)
264.273(c),(d)
264.221(c)

Waste Pile - 40 CFR 264.251

Regulation	Standard
OAR 340-101	Identification and Listing of Hazardous Waste - will determine which wastes at the site are considered hazardous
OAR 340-102	Standards Applicable to Generators of Hazardous Waste - will determine which wastes at the site are considered hazardous.
OAR 340-104	Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities - establishes closure and post closure care of surface impoundments and waste piles.
OAR 340-108	Oil and Hazardous Material Spills and Releases -regulates emergency spill reporting and cleanup standards.
ORS 466-005 to ORS 466-995	Hazardous Waste and Hazardous Materials - Covers hazardous waste disposal and treatment, monitoring requirements.
OAR 340-130	Notice of Environmental Hazards - pertains to institutional controls at the site

Solid Waste

Regulation	Standard
OAR 340-61	Solid Waste Management - covers storage, disposal and treatment of solid waste.
ORS 459-005 to 459-355	Solid Waste Control - same as above.

Air Quality

Depending on the type of action designed, the regulations described below may contain specific requirements in addition to the chemical specific air pollution regulations cited earlier.

Regulation	Standard
OAR 340-20	Air Pollution Control - details contained in regulations cited below.
OAR 340-20-001	Highest and Best Practicable Treatment and Control Required
OAR 340-20-040	Methods
OAR 340-20-240	Requirements for Sources in Non-attainment Areas
OAR 340-20-225	Significant Emission Rate
OAR 340-20-245	Prevention of Significant Deterioration
OAR 340-20-245(5)	PM10 Monitoring Requirements
OAR 340-21	General Emission Standards for Particulate Matter
OAR 340-31	Ambient Air Quality Standards

Oregon Occupational Safety and Health Code

Regulation	Standard
OAR 437-40	General Provisions
OAR 437-50	Personal Protective Equipment
OAR 437-83	Construction
OAR 437-100	Inorganic Arsenic
OAR 437.114	Air Contaminants
OAR 437.129	Protective Equipment. Apparel. and Respirators
OAR 437.136	General Occupational Health Regulations

Transportation of Hazardous Materials

OAR 860.66.055 to 860.66.072

C. FEDERAL LAWS AND REGULATIONS TO BE CONSIDERED

- Safe Drinking Water Act (SWDW) (42 USC 300):
  Drinking Water Standards (40 CFR 141), including secondary standard for sulfate.

- Clean Water Act (CWA) (33 USC 1251):
  Water Quality Criteria (EPA440/5-86-001).

D. STATE OF OREGON LAWS AND REGULATIONS TO BE CONSIDERED

Oregon Land Use Goals:

OAR 660.15.000(6)
Goal 6. Air, Water and Land Resources Quality - Establishes that discharges shall not exceed the carrying capacity of air water or land and shall not violate applicable Federal or State environmental quality statutes and regulations.

Water Quality Regulations

OAR 340-41-445	2.2 mg/l Arsenic Standard for Protection of Human Health from Water and Fish Ingestion 17.5 mg/l Arsenic Standard for Protection of Human Health from Fish Ingestion Only 1.00 mg/l Barium Standard for Protection of Human Health from Water and Fish Ingestion 2.8 ng/l Polyaromatic Hydrocarbon Standard for Protection of Human Health from Water and Fish Ingestion 31.1 ng/l Polyaromatic Hydrocarbon Standard for Protection of Human Health from Fish Ingestion only 42 ug/l Fluoranthene Standard for Protection of Human Health from Water and Fish Ingestion 54 ug/l Fluoranthene Standard for Protection of Human Health from Fish Ingestion only
OAR 340-41-525	22 mg/l Cyanide Standard for Protection of Aquatic Life - Fresh Acute 5.2 mg/l Cyanide Standard for Protection of Aquatic Life - Fresh Chronic 1,700 ug/l Acenapthene Standard for Protection of Aquatic Life - Fresh Acute 520 ug/l Acenapthene Standard for Protection of Aquatic Life - Fresh Chronic 3,980 ug/l Fluoranthene Standard for Protection of Aquatic Life - Fresh Acute
OAR 340-41-001 to 340-41-029	State Wide Water Quality Management Plan - regulates groundwater quality.
OAR 340-41-442 to 470	Willamette Basin - establishes beneficial uses to be protected and water quality criteria not to be exceeded.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WASHINGTON

RECORD OF DECISION, DECISION SUMMARY AND RESPONSIVENESS SUMMARY

FOR

FINAL REMEDIAL ACTION
MARTIN MARIETTA SITE
THE DALLES, OREGON
SEPTEMBER, 1988

APPENDIX B
RESPONSIVENESS SUMMARY

Overview:

EPA conducted community interviews, sent out fact sheets, published notices, and held two public meetings to identify community concerns and ensure two-way communication about progress and the results of the RI/FS.

Community concern about the Martin Marietta site has never appeared to be widespread, although several issues and questions were raised. These three issues were raised by several community members:

1) the concern over cyanide contamination;
2) the importance of the aluminum reduction facility to the local economy; and
3) concerns about various airborne emissions from the smelter.

The remedial investigation addressed the concerns about cyanide, concluding that there is no significant cyanide contamination in groundwater beneath the site. The reduction facility was leased and reopened by NW Aluminum, which has improved their practices for handling the wastes which earlier caused the contamination now beneath the site. As a result of a lawsuit, Martin Marietta had previously installed new flouride emission control equipment.

Judging from the fact that EPA received no written comments on the Feasibility Study despite two public meetings, two fact sheets, and several public notices about the Feasibility Study and comment period, EPA concludes that the community's concerns have been addressed and that they are relying on EPA and DEQ to select an appropriate remedy. The selected remedy takes into account the concerns mentioned above and all other questions discussed below.

Background on Community Concerns:

1) At the time this site was listed, there was community concern about cyanide contamination or other groundwater contamination that might potentially affect Chenoweth Irrigation Cooperative wells which rely on the deep water aquifer.

EPA Response: The Remedial Investigation revealed low levels of cyanide in the groundwater that were below health standards. Based on the RI, EPA beleves that such groundwater contamination which does exist is within the site boundaries and does not seem to be moving to off-site receptors. To ensure that no future problems occur without warning, on and off-site monitoring will continue for at least five years after the remedial action is completed.

2) Many individuals stressed the importance of the aluminum reduction facility to the local economy and their concern that Superfund requirements or actvities might preclude sale or reopening of the then-closed facility.

EPA Response: The facility, which was closed when this concern was expressed, has subsequently been leased to Northwest Aluminum, which continues to operate the facility. Since Martin Marietta, not NW Aluminum, has been involved in remedial work at this site, the selected remedy is not expected to affect Northwest Aluminum operations or the local economy.

3) Some community members have been critical of the aluminum plant because of the odor and air pollution it created.

EPA Response: This Superfund investigation focussed on hazardous soil and groundwater contamination from past practices. EPA did not identify any significant risk from air emissions from the Superfund site.

4) Port representatives expressed concerns about possible impacts of contamination or the "stigma" of Superfund affecting future development of industrial property along the Columbia River.

EPA Response: It is not expected that the contamination found, or remedial actions to be taken, will affect development.

5) Some individuals who own cherry orchards fought with and successfully sued Martin Marietta over damages to cherry crops that the orchardists attributed to flouride emissions from the plant. The cherry growers won several lawsuits and Martin Marietta was required to install a new process to reduce flouride emissions.

EPA Response: As stated above, the focus of the investigation was on past practices.

Community Relations and Concerns Raised During Public Comment on the RI/FS:

EPA, with help from state officials, held a 35-day public comment period on the feasibility study, including a public meeting on 7/18/88 attended by about 30 people. Shortly before the public comment period EPA held a public meeting with help from DEQ and Martin Marietta's consultants to discuss the Remedial Investigation results.

Questions from the Feasibility Study Public Meeting Held 7/18/88

1. What institutional controls have been discussed and exactly where is the agency proposing these controls?

EPA Response: The agency has looked at several different institutional controls. For example, deed restrictions or fencing on the plant property could be used to restrict acees to certain areas to prevent direct contact or to restrict on-site groundwater use. The agency has also looked at controls such as deed restrictions to restrict groundwater use off-property, if necessary.

2. What is being done differently today at the plant so that contamination is no longer occuring?

EPA Response: One of the main differences is that cathode waste found in the landfill area has been moved to a better protected area and is being handled safely to prevent ground contamination. NW Aluminum has also proposed to construct a new treatment plant for handling water from the roof scrubber system, which would allow the plant to discontinue the use of the recycle pond for that purpose.

3. Which way is groundwater under the landfill flowing - is it flowing toward the Columbia River?

EPA Response:

Groundwater flow in the S Aquifer is generally to the east and northeast; groundwater flow in the A Aquifer is predominantly east to west; groundwater flow in the B aquifer is generally to the west and south; in the DGWR groundwater flow is largely determined by local pumping conditions.

4. What considerations are being given to long-range monitoring of off-site wells in the area?

EPA Response: EPA's selected remedy will include an appropriate level of groundwater protection, including monitoring. EPA will be working with the City of The Dalles and the Clearwater Irrigation District to develop adequate monitoring. Superfund remedies are also reevaluated after 5 years to ensure that they are working properly.

5. Was there any study on sturgeon in the river and whether the pollution has affected them?

EPA Response: No specific studies, although relevant information, received by NOAA for national resource implications, do not indicate any such problems. Several people requested more information, which was provided.

Issues for further consideration:

Community members should be informed of monitoring plans. All other issues appear to have been addressed.

APPENDIX C
ADMINISTRATIVE RECORD

not included

APPENDIX D
STATE LETTER OF CONCURRENCE

Department of Environmental Quality

811 SW SIXTH AVENUE, PORTLAND, OREGON 97204-1334 PHONE (503) 229-5696

September 26, 1988

Robie Russell
Regional Administer
Environmental Protection Agency
1200 Sixth Avenue
Seattle, WA 98101

Re: Martin Marietta Selected
Remedial Action Certification

Dear Mr. Russell:

The Oregon Department of Environmental Quality (DEQ) has carefully reviewed the EPA selected remedial action in the draft record of decision (ROD). The Department concurs with EPA's selected remedy based on alternative 3 of the feasibility study. This selected remedial action satisfies the statutory requirements for a remedy as required by the State of Oregon. It has been determined that the selected remedial action complies with the applicable or relevant and appropriate requirements (ARARs) as identified to you in the Department's letter of July 15, 1988, with the following exceptions:

Contaminant	Alternate Concentration Limit
Fluoride	9.7 mg/l
Sulfate	3,020 mg/l

These alternate concentration limits (ACLs) have been reviewed by the Department. It has been determined that these ACLs will be protective of human health, welfare and the environment in the context of this selected remedy.

Department staff are available to provide you additional information, if necessary. The appropriate DEQ contact is William Renfroe, (503) 229-6906.

Sincerely,

Fred Hansen
Director

WR:f
ZF3470
cc: Mike Downs, ECD
Kurt Burkholder, AG
Dick Nichols, WQ
Tom Bispham, RO
Jim Boydston, HD
Chuck Findley, EPA
Bill Sobolewski, EPA OOO